ezTrap

Race Course Designer

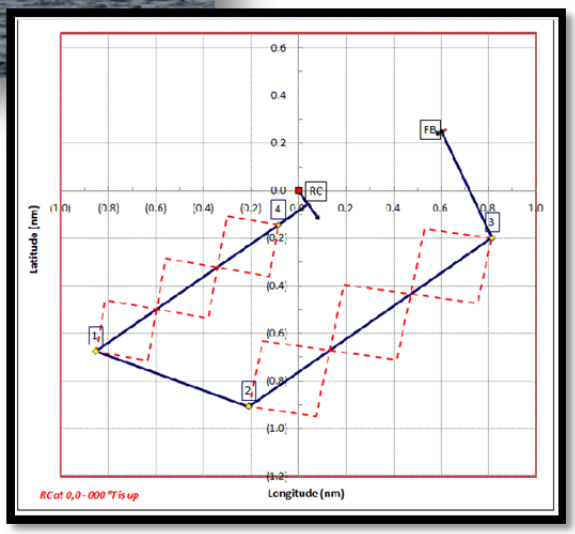
A MS Excel® based app for Race Officers and Course Setters

- Trapezoid
- Triangle
- Optimist
- Windward Leeward
- Lipton Cup
- Yacht Club
- RS:X Slalom

ezTrap **User's Manual**

v13.1

April 2013



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1. Why ezTrap ?

1.1 Going Digital

The advent of inexpensive marine GPS devices and computers on board has provided significant opportunities to improve the sport of sailboat racing. Without a doubt, the use of GPS has improved the quality of race courses because of the availability of key information such as the bearing and distance from another object (e.g. RC Signals boat), which makes setting a typical W/L course relatively simple. With a little bit of homework, even a trapezoid course can be set by simply using range & bearing information.

However, the challenges can quickly mount with changes in racing conditions, dissimilar fleets on the same course, and getting to acceptable Target Race Times. ezTrap not only solves these challenges and more, but also provides instant Latitudes & Longitudes for all marks and pins, which are key data elements for accurate and precise GPS navigation.

At the time of writing, ezTrap is in its 4th year of availability and is unique in its integrated capabilities for designing sailboat race courses. It is being used by Race Officers (ROs & PROs) and Course Setters for local, regional, national, and international regattas around the world.

In the very near future, we see new computer technology, such as tablets and smart phones, with the capability of supporting ezTrap or similar systems when they become available.

1.2 Key Benefits

- **Short Design Time**: In sailboat racing, time is a critical success factor for setting and changing the course. Once the RC Signals Boat is in position and the Wind Direction determined, an ezTrap course can be designed (or re-planned) within seconds to meet the Target Race Time. The complexities of designing Trapezoid and other courses are minimized.

- **Accuracy and Precision**: ezTrap was built using Microsoft Excel®, which accurately calculates Latitudes and Longitudes (using spherical trigonometry), leg lengths, angles, times, etc. to a very high precision. Using simple Input Values, ezTrap instantly makes the complex calculations and displays the results. ezTrap has been validated to be accurate and precise; for example, Latitudes and Longitudes are displayed to the nearest 0.001' or about 6-10 feet.

- **Faster Set-up and Change Time**: Again, time is of the essence when setting or changing a course. ezTrap not only provides Range and Magnetic Bearings to/from each Mark it also provides Latitudes & Longitudes, allowing Mark Boats (equipped with GPS) to quickly find the proper mark position. Further, multiple marks can be set (or reset) concurrently instead of serially. The Range and Bearing information can be useful for ROs and/or Mark Setters with hand-held compasses; however, the real-world results are considerably less accurate because of the difficulty in getting a hand-held bearing in rocking boat.

- **Optimization**: ezTrap provides several embedded algorithms that automatically optimize characteristics of the race course including calculation of the ideal W/L and Reach leg length(s) to meet the Target Race Time(s) and desired fleet spacing.

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- **Uniform High Quality**: The essential geometry of each ezTrap course is predefined to international standards, where they exist, and repeatable anywhere in the World to meet consistent high quality expectations.

- **Flexibility**: Numerous Input Values are available for designing (and tweaking) most ezTrap courses to meet the capabilities of the fleet(s), current racing conditions, Target Race Times, RC/mark boat resources, and objectives of the RO.

- **Confidence**: ezTrap greatly reduces the likelihood of human error and provides a high-degree of confidence in the squareness, integrity, and high quality of the course, which is especially important for championship racing.

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2. Getting Started with ezTrap

ezTrap is a Microsoft Excel®-based spreadsheet tool that helps design and manage a large variety of sailboat race courses anywhere in the world. It does not replace the need for a competent race officer (RO) or Course-Setter, but it greatly speeds up the process and helps optimize the value of the race by providing many course related calculations instantly and accurately, especially the Latitudes & Longitudes of all marks and pins.

ezTrap is a sophisticated MS Excel® application with a number of embedded worksheets; however, the user only needs to work with a single easy-to-use worksheet for any of the courses. Also, a separate tab of relevant notes is provided for each course for quick reference.

2.1 Organization of this Manual

The User's Manual has three basic parts:

- Getting Started section that explains the basics common to all ezTrap Course Families;
- Separate sections for each of the Course Families and their unique characteristics; and,
- Support section including a Glossary of Terms.

2.2 Families and Course Variations

The ezTrap v13 bundle is composed of four families of 11-courses, each of which may have a number of variations.

- Trapezoid, Optimist, and RS:X Slalom
  - Trap6
  - Trapezoid
  - Opti
  - RS:X Trap
- Windward/Leeward, Lipton "S", and RS:X LS Slalom
  - WL & LiptonS
  - RS:X LS
- Yacht Club - Custom Design
  - Club
- Triangle, Lipton Triangle 'T', 'O' & 'R'
  - Triangle
  - LiptonT
  - LiptonO
  - LiptonR

2.3 Features by Course

The features of V13 are shown on the next page including the Free W/L Course.

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Regatta v13 Features	*Trapezoid & Trap6 w/1a*	*Windward Leeward*	Optimist	*RS:X Slalom Trap & LS*	*Yacht Club (Custom)*	Triangle	*Lipton Cup*	Free W/L
Courses	2	1	1	2	1	1	4	1
Variations	3	5	1	6	variable	3	10	1
Adjustable Finish Leg	✓	✓	✓	✓		✓		
Adj. Start/Finish Line Lengths	✓	✓	✓	✓	✓	✓	✓	✓
Adj. Tack Angle w/Leeway	✓	✓	✓	✓	✓	✓	✓	✓
Calc. Mark Locations within 10' (3m)	✓	✓	✓	✓	✓	✓	✓	✓
Course Graphic to Scale (nm)	✓	✓	✓	✓	✓	✓	✓	✓
Custom Course Design					**12-Legs**			
Fixed Marks Support					**12-Marks**			
Global Lat's, Long's & Variance	✓	✓	✓	✓	✓	✓	✓	✓
Leg & Cumulative Time	✓	✓	✓	✓	✓	✓	✓	✓
Leg & Distance Sailed (nm)	✓	✓	✓	✓	✓	✓	✓	✓
Leg HDGs & BRGs	✓	✓	✓	✓	✓	✓	✓	✓
Magnetic & True Directions	✓	✓	✓	✓	✓	✓	✓	✓
Mark Latitudes & Longitudes	✓	✓	✓	✓	✓	✓	✓	✓
Mark to/from RC BRGs & Distance	✓	✓	✓	✓	✓	✓	✓	✓
Metric Support	✓	✓	✓	✓	✓	✓	✓	✓
PC MS Excel Compatibility 2003-2013	✓	✓	✓	✓	✓	✓	✓	✓
Pin or Mid-point Course Alignment	✓	✓	✓	✓		✓	✓	✓
Point of Sail Avg. Speed Support	✓	✓	✓	✓	✓	✓	✓	✓
Point of Sail Statistics	✓	✓	✓	✓	✓	✓	✓	✓
Start Line Offset Mark	✓	✓		✓		✓	✓	✓
Target Race Time Re-Sizing	✓	✓	✓	✓		✓	✓	✓
Third Fleet Support - Inner Mk1a	✓							
Two Fleet Support w/Adj. Spacing	✓			✓				
Variable Angle at Mark 1	✓			✓	✓	✓		✓

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2.4 Checklist

Although most people will find ezTrap very easy to use for the first time in a matter of minutes, it is highly recommended that a new user completely familiarize themselves with the Course(s) they plan to use, and to practice changing the Input Values that ezTrap uses to create a course, and to observe the various effects.

The following add-on checklist is suggested to help ROs plan and execute an ezTrap course:

- Pre-planning
  - Review NOR, SI, etc. for any special requirements
  - Determine the starting-point parameters for the fleet(s) such as probable location of RC-Signals Boat, expected size of the course and potential interferences, number of boats, average LOA, average boat speeds (i.e. beat, run, and reach) given expected conditions, tidal or other currents, etc.
- Computer:
  - Appropriate PC with a screen size and view-ability for the conditions expected
  - Printer, if hard-copy is required
  - Up to date version of MS Excel® 2003, 2007 or 2010, with macros enabled
  - Adequate battery life for the day or access to compatible AC/DC power
  - Current version of ezTrap in the correct file format:
    - .xlsm for Excel® 2007, 2010, or 2013 systems
    - .xls for Excel® 2003 systems
  - User's Manual, and pre-printed 'Notes' from the spreadsheet may be helpful.
- RC-Signals and Mark Boats
  - GPS, chart or chart plotter
  - Communications (e.g. VHF, GMRS/FRS, Cell)
  - Mark setter and crew training. Note that ezTrap provides a quick refresher entitled "Essentials of Navigation", which is available for free download from the website 'Documents' or 'Downloads' pages.

2.5 Working with Microsoft Excel®

ezTrap was developed using Microsoft Excel® 2010 and will work with Excel 2007 or 2013 without any technical modifications or additions. It is also available in a separate Excel® 2003 format (.xls) that works properly; however, the .xls version has been further modified by the developer and cannot be duplicated by simply saving the .xlsm version as .xls.

Both versions are self-contained in that ezTrap does not require access to any external programs or data in order to operate. It does contain several user controlled Visual Basic for Applications (VBA) macros for the graphical plot of the course, and navigation. As such, in order to work properly, macros must be enabled on the user's computer. If there are any macro security concerns please email us at ezTrap@xl4Sail.com

It also has hyperlinks to the ezTrap website and to the National Oceanic and Atmospheric Administration (NOAA) website for magnetic declination (i.e. Variation). The macros and hyperlinks are explained further in the sections that follow.

Microsoft Excel® is a feature rich and potentially complex software environment that can be utilized by people of all skill levels. Although ezTrap makes use of a number of sophisticated features, every reasonable effort has been made to keep the user-interface simple, and easy to use. If you see ways to improve this user-interface, please let us know by email to ezTrap@xl4Sail.com.

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The following tips and techniques may be helpful.

2.5.1 Security

ezTrap utilizes several levels of security. The main course and 'Notes' worksheets use Worksheet Password Protection to prevent the user from accidently changing fixed or calculated values while allowing the user to change Input Values at will.

Note: You may need to change your Trust Center Settings to enable macros… use Office Button, Excel Options, Trust Center, Settings, Enable all

Workbook and Macro Password Protection, and hidden worksheets are utilized to prevent the user from changing any of the underlying formulae, constants, or structure.

2.5.2 Data Validation

Excel's Data Validation function is utilized for many Input Values to ensure that the data entry is valid and appropriate. In some cases, a Data Validation Message will pop-up to describe the expected range of values to be input. For example, N or S Latitude is restricted to values between 0° and 88° 59.9999'.

Microsoft Office Excel
The value you entered is not valid.
A user has restricted values that can be entered into this cell.
Retry
Cancel
Help
Was this information helpful?

In some cases, otherwise valid Input Values may create an impossible or unreasonable course, which may also be apparent on the Course Plot. ezTrap identifies many of these conditions, provides a warning message (e.g. ***Warning - Unreasonable Course Parameters***), and highlights the relevant information.

nm	Metres	Feet
1.00	1,852	6,076
0.02	30	100
0.08	152	500
0.16	305	1,000
0.03	50	164
0.05	100	328
0.08	150	492
0.05	93	304
0.10	185	608
0.15	278	911

2.5.3 Excel® Data Entry Notes

Input Values may be entered with a keyboard followed by the 'Enter' key. Some Input Values can also be entered from a pull-down menu by left-clicking on the field, then left clicking on the desired value. Information can also be entered using the MS On-Screen Keyboard (osk.exe).

- **Message:** Many ezTrap input fields have a message that pops up when the cell is selected. These can often obscure other information nearby but can be moved by left-clicking & holding the cursor over the message then sliding it to an out-of-the way position on the screen. The messages will stay in the new position until ezTrap is restarted.
- **Pull-Down List:** Some input fields have pre-established values that can be selected by cursor or entered by keyboard. When a cell having a Pull-Down List is selected, a little box with a down-arrow appears – clicking the arrow will display the valid choices, which can be selected with the cursor.
- **MS Excel® Error Messages:** Some fields have data validation to ensure that input value falls within an acceptable range or conforms to valid choices. If the error message pops up, the user should click re-try and re-enter valid information or click cancel. Note that the Pull-Down List may not work properly during re-try. Alternatively, pressing 'Esc' should return the field to the previous value.
- **Lower Case Letters:** There is no specific support for lower case letters (e.g. Variation – E or W, Latitude – N or S, or Longitude – E or W). Please enter the upper case letters or choose from the Pull-Down List.
- **Percentages:** Fields such as Inner/Outer Spacing are formatted as percentages, and accept input as a percentage. For example, with the cell selected, the sequence 125 can be entered with or without the '%' symbol for 125%. However, after some data entry problems, Excel® will expect a decimal number, and not a percentage. If that happens, then either '125%'

Mark 4 Spacing
Enter spacing between Start Line and Mark 4. Decimal number between 0-6,076 feet, Meters, or nm

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or '1.25' should produce the same result. Be sure to check the resultant number. Also, pressing 'Esc' should return the field to the previous value.

- **Distance Measures - Nautical Miles, Metres, and Feet:** ezTrap supports data entry of some fields using feet (Ft.), metres (M) or Nautical Miles (nm). Note that 1.0 nm = 6,076 ft. A simple metric conversion table is provided in several places in this manual and on the 'Notes' page of each course to help the user with conversions.

2.5.4 Saving ezTrap Files

The user may save files in a normal manner - ezTrap will not stop the user from saving or copying files. However, ezTrap does use the filename (bottom left corner) and current date (bottom right corner) when printing the display. Note that the Input Values are retained when the file is saved, and not reset when restarted.

The user may want to save one or more variations of a course as the design evolves or changes, or as a record of what was used for an event. One suggested approach is to vary the filename utilizing the current date & time such as: '20100407-1445 ezTrap Opti Nationals.xlsm'.

Further, some users save 'master' or 'template' files with pre-set parameters such as the Fixed Mark Table and/or Course Definitions for the Yacht Club Course. This can be very useful for an RO to select among many options depending on the current racing conditions.

2.5.5 Printing from ezTrap

The user may print in the normal manner; however, the print-outs are scaled for 1-page, Letter sized paper – Landscape or Portrait. Most printer drivers can be modified to scale up or otherwise print on different sized papers (e.g. A4).

Depending on other factors (e.g. version of MS Windows and/or Excel®, availability of Adobe Acrobat, etc.) the user can also print to a file in a standard electronic format such as **.xps** – XML for Paper Specification, or **.pdf** – Adobe Portable Document Format for viewing or printing later. Your computer operating system and MS Excel® Help functions can provide more information on this topic.

2.5.6 Remote Access and emailing Results

For those ezTrap users that have access to the internet and email coverage on the race course(s), there are several ways to send results to interested parties. A **Shore-based or Master Course Setter** with a PC and ezTrap can quickly build (or change) a course with the basic input values, then communicate the Mark Information to the ROs and Mark Boats.

In addition to verbal communication (e.g. radio or cell phone), the text of the Mark Information can be sent by email to ROs and Mark Boats with smart phones by simply swiping the information off the screen and pasting it into an email message. If the smart phones are capable, a printout of the course (see above) can be emailed.

Remote connection software is available (e.g. VNC) to allow any PC, Mac, tablet, or smart phone with access to the internet to access a PC running Excel® and ezTrap. Other networking solutions (e.g. outdoor WiFi) are also possible.

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2.6 *Index of ezTrap Courses*

The first tab in the workbook is the Index of Courses (shown below) grouped in four families.

Index of ezTrap Courses — v13.1 — Hide/Open all Courses

Course Name	Total Legs	W/L Legs	Description
Trapezoid, Optimist, and RS:X Slalom			
Trap6	6	2	6-leg Partial Trapezoid, with Inner/Outer Courses supporting three fleets. Variable Finish Leg angle, distance. Optional 1a Mark.
Trapezoid	7	3	7-Leg Full Trapezoid, with Inner/Outer Courses supporting two fleets. Variable Finish distance.
Opti	4	2	Partial Trapezoid with variable, upwind finish along M3-M2 leg.
RS:X Trap	9	2	Once around RS:X Windsurfer Trapezoid Slalom course
	11	3	Twice around RS:X Windsurfer Trapezoid Slalom course
	13	4	Three times around RS:X Windsurfer Trapezoid Slalom course
Windward/Leeward, Lipton "S", and RS:X LS Slalom			
W/L & LiptonS	3	2	Once around Windward/Leeward Course with an upwind Finish at M1. Equivalent to the **Lipton Challenge Cup S-1 Course** with Pin alignment, 100% Finish Leg Distance, and zero offset.
	4	2	Twice around Windward/Leeward Course with a downwind Finish at start.
	5	3	Twice around Windward/Leeward Course with an upwind Finish at M1. Equivalent to the **Lipton Challenge Cup S-2 Course** with Pin alignment, 100% Finish Leg Distance, and zero offset..
	6	3	Three times around Windward/Leeward Course with a downwind Finish at start.
	7	4	Three times around Windward/Leeward Course with an upwind Finish at M1. Equivalent to the **Lipton Challenge Cup S-3 Course** with Pin alignment, 100% Finish Leg Distance, and zero offset..
RS:X LS	6	1	Once around RS:X Windsurfer W/L Slalom course
	8	2	Twice around RS:X Windsurfer W/L Slalom course
	10	3	Three times around RS:X Windsurfer W/L Slalom course
Yacht Club - Custom Design			
Club	12-legs max.		Suitable for Yacht Club Racing. Up to 12-legs. Custom built by using any combination of fixed or moveable marks. Up to 12-Fixed Marks are pre-defined in a table and can be used for any leg. Point of Sail Stats are calculated to help Course Planner balance beats, reaches and runs.
Triangle, Lipton Triangle 'T', 'O' & 'R'			
Triangle	5	2	Triangle + W/L Course using the Start-Line Pin as the Leeward Mark & Finish
	5	2	Triangle + W/L Course with a short downwind Finish at the Start-Line.
	6	3	Triangle + W/L Course with a variable upwind Finish.
LiptonT	4	2	Once around Equilateral Triangle Course with an upwind finish at M1.
	7	3	Twice around Equilateral Triangle Course with an upwind finish at M1.
	10	4	Three times around Equilateral Triangle Course with an upwind finish at M1.
LiptonO	9	4	Isosceles Triangle + W/L Course, repeated again with an upwind finish at M1.
LiptonR	5	2	Once around Rectangular Course with an upwind finish at M1.
	9	3	Twice around Rectangular Course with an upwind finish at M1.
	13	4	Three times around Rectangular Course with an upwind finish at M1.

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The Total legs, windward/leeward legs, and description are shown for each course. To help the user with selecting and using the proper course(s), there are several buttons to display or hide course and notes tabs:

- The yellow **Hide/Open all Courses** button will hide or display all courses and notes.
- Clicking on the colored box with the course name will display the course tab. Clicking the colored box a second time will transfer the user to the course or the user can simply click on the tab to transfer to the course.
- Once a course tab is opened there is no provision to hide the individual course; however, the yellow **Hide/Open all Courses** button can be used to close all tabs.
- The user can display and transfer to the notes associated with any course by clicking the green **Display or Hide Notes** button on any course tab. If the notes tab is already open, then clicking the green button will hide the notes tab.
- The user can return to the Index by clicking the red arrow labeled **Index** on any course tab.

Clicking any of these buttons in any sequence does not affect the data entered or results displayed for any course.

2.7 ezTrap Course Display

There are six areas on each display that are common to all courses and are explained in this section:

- Header
- Input Values
- Mark Information
- Course Information
- POS Statistics
- Course Plot.

Some Course Families have additional Input Values and display information that are further explained in the detailed sections of this manual. The following page shows a typical display (7-leg Trapezoid).

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ezTrap Course Display (**Trapezoid**)

Trapezoid Course (7-legs)
Inner: Start-1-4-1-2-3-5-Finish
Outer: Start-1-2-3-2-3-5-Finish

Index

Today	3-Mar-13
Expiry	7-Apr-18

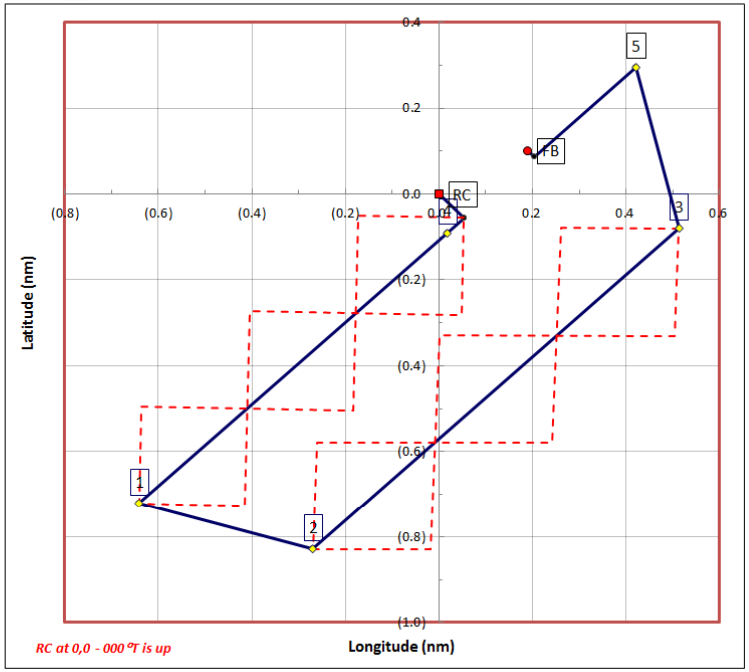
v13.0

Reset | Make Grid Square | Display or Hide Notes | ezTrap

INPUT VALUES

Mag. Wind Direction	245	°M →°T	226	Course Type	Trapezoid	
Area Variation	18.8	W		Marks 1&4 Align.	Pin	
				Mark 1 Included Angle	60	°
	Degrees	*Minutes (decimal)*				
RC Latitude	44	38.000	N			
RC Longitude	63	58.000	W	M4 Offset	0.05	nm
	Inner		*Outer*	Finish Leg Dist.	0.30	nm
Max. Fleet Size	30	Boats	30	Outer/Inner Spacing	100%	
Avg. Boat LOA	14.0	Feet	14.0	Reach/1st Leg Ratio	40%	
Avg. Speed-Beat	4.8	Kt	5.0			
Avg. Speed-Run	6.0	Kt	8.0			
Avg. Speed-Reach	7.0	Kt	10.0	Start-Line Len. Factor	110%	
Avg. Tack Angle	90	Deg.	88	Calc. Start-Line Length	470	Feet
Target Race Time	65	Min.	60	Calc. Fin.-Line Len.(25%)	120	Feet

MARK INFORMATION ID	Name	From RC BRG °M	To RC BRG °M	Dist. nm	Latitude	Longitude
RC	RC Signals Boat	000	000	0.00	44° 38' N	63° 58' W
Pin	Pin-Start Line	155	335	0.08	44° 37.944' N	63° 57.925' W
1	Inner Weather	240	060	0.96	44° 37.279' N	63° 58.9' W
2	Outer Weather	217	037	0.87	44° 37.171' N	63° 58.378' W
3	Outer Leeward	118	298	0.52	44° 37.92' N	63° 57.281' W
4	Inner Leeward	188	008	0.09	44° 37.909' N	63° 57.975' W
5	Inner Finish	074	254	0.51	44° 38.295' N	63° 57.41' W
Fin-Pin	Finish Pin	086	266	0.22	44° 38.087' N	63° 57.714' W
Fin-Boat	Finish Boat	081	261	0.22	44° 38.102' N	63° 57.733' W



Inner Leg	Marks	POS	Length (nm) Leg	Dist. Sailed	Est. Sail Time Leg	Cum.	Headings °T	°M
1	Start-1	Upwind	0.96	1.36	*0:17:00*	*0:17:00*	226	245
2	1-4	Downwind	0.91	0.91	*0:09:07*	*0:26:07*	046	065
3	4-1	Upwind	0.91	1.29	*0:16:07*	*0:42:14*	226	245
4	1-2	Reach	0.39	0.39	*0:03:19*	*0:45:33*	106	125
5	2-3	Downwind	1.08	1.08	*0:10:50*	*0:56:23*	046	065
6	3-5	Reach	0.39	0.39	*0:03:19*	*0:59:42*	346	005
7	5-Finish	Upwind Finish	0.30	0.42	*0:05:18*	*1:05:00*	226	245
		Totals (nm)	**4.94**	**5.84**	***1:05:00***			

Outer Leg	Marks	POS	Length (nm) Leg	Dist. Sailed	Est. Sail Time Leg	Cum.	Headings °T	°M
1	Start-1	Upwind	0.96	1.34	*0:16:03*	*0:16:03*	226	245
2	1-2	Reach	0.39	0.39	*0:02:19*	*0:18:22*	106	125
3	2-3	Downwind	1.08	1.08	*0:08:07*	*0:26:29*	046	065
4	3-2	Upwind	1.08	1.51	*0:18:04*	*0:44:33*	226	245
5	2-3	Downwind	1.08	1.08	*0:08:07*	*0:52:40*	046	065
6	3-5	Reach	0.39	0.39	*0:02:19*	*0:54:59*	346	005
7	5-Finish	Upwind Finish	0.30	0.42	*0:05:00*	*0:59:59*	226	245
		Totals (nm)	**5.28**	**6.20**	***0:59:59***			

Distance Sailed - Inner

POS	nm	%nm	Time	%Time
Beat	3.07	53%	*0:38:25*	59%
Run	1.99	34%	*0:19:57*	31%
Reach	0.77	13%	*0:06:38*	10%
Total	**5.84**	**100%**	***1:05:00***	**100%**

Distance Sailed - Outer

POS	nm	%nm	Time	%Time
Beat	3.26	53%	*0:39:07*	65%
Run	2.17	35%	*0:16:14*	27%
Reach	0.77	12%	*0:04:38*	8%
Total	**6.20**	**100%**	***0:59:59***	**100%**

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2.8 Header Information

Each course header is unique but contains the same basic information including the sequence of the course type selected. The following header is from the **Trap6** Course:

2.8.1 Name and Sequence of Courses

The left side of the header contains a descriptive name of the course and the sequence. Where multiple variations of the course are supported, the header information will change to match the Course Type selected in the Input Values.

2.8.2 Index Arrow

Clicking the red index arrow will cause ezTrap to move to the first tab in the workbook, which is the Index or Menu of all Courses, shown below.

2.8.3 Key Dates and EXPIRED Message

Today's date and the ezTrap expiry date are displayed. If the expiry date is less than today's date, the message ***EXPIRED*** will appear below the Expiry Date field. If ***EXPIRED***, the spreadsheet will continue to work; however, the wind direction will be fixed at 000° T.

2.8.4 Version Number

The ezTrap version number is displayed for reference purposes only. Be sure to reference this number when communicating any questions or issues. Additional comments about the current versions available are described on the website at… **http://www.xl4sail.com/support.html**

2.8.5 Reset, Make Grid Square, Display or Hide Notes Buttons

The **Reset** and **Make Grid Square** buttons are explained later in the Course Plot section.

The **Display or Hide Notes** button will toggle the display of Notes related to the current course. If the course notes tab is displayed, clicking the **Display or Hide Notes** button will hide the notes. If it is hidden, the notes tab will appear and the display will switch to the course notes.

2.8.6 Logo

The ezTrap logo appears on every page and contains a hyperlink to the website.

2.9 Input Values

The only information the user needs to enter is contained in the Input Values box – specifically the parameters that are highlighted. No Excel® programming skills are required, and the results are instantaneous. Any of the parameters may be changed to instantly see the effects. The Input parameters and results may be saved for future reference.

All ezTrap Course Families have some common Input Values (**Trapezoid** shown below), which are described in the following sections.

INPUT VALUES							
Mag. Wind Direction	245	°M →°T	226	Course Type	Trapezoid		
Area Variation	18.8	W		Marks 1&4 Align.	Pin		
				Mark 1 Included Angle	60	°	
	Degrees	Minutes (decimal)					
RC Latitude	44	38.000	N				
RC Longitude	63	58.000	W	M4 Offset	0.05	nm	
	Inner		Outer	Finish Leg Dist.	0.30	nm	
Max. Fleet Size	30	Boats	30	Outer/Inner Spacing	100%		
Avg. Boat LOA	14.0	Feet	14.0	Reach/1st Leg Ratio	40%		
Avg. Speed-Beat	4.8	Kt	5.0				
Avg. Speed-Run	6.0	Kt	8.0				
Avg. Speed-Reach	7.0	Kt	10.0	Start-Line Len. Factor	110%		
Avg. Tack Angle	90	Deg.	88	Calc. Start-Line Length	470	Feet	
Target Race Time	65	Min.	60	Calc. Fin.-Line Len.(25%)	120	Feet	

2.9.1 Magnetic Wind Direction (000-359 °M)

This value is entered as a positive whole number between 000-359 degrees-magnetic (°M) by the user based on the current reading of the wind direction from a magnetic compass. Decimal numbers or numbers outside this range are rejected. The wind direction is immediately converted to degrees-true (°T) by using the Area Variation, discussed in the next section.

Note: A ship's magnetic compass can also be affected (Deviation) by onboard metals and other factors that are not taken into account by ezTrap. Ship's compass readings should be corrected (Compass Deviation Card) to Magnetic before using. A hand-held magnetic compass can generally be relied upon for Magnetic readings without adjustment for Deviation.

2.9.2 Variation (0-60 Degrees, E-Easterly or W-Westerly)

The local area Variation is entered as a positive whole or decimal number along with the Easterly (E) or Westerly (W) Variation attribute.

Note: Although °V can be entered with partial (decimal) degrees, the °T & °M values displayed by ezTrap are expressed as whole numbers between 000-359.

Variation (magnetic declination) is the difference between magnetic and true North, which is measured in degrees East or West for a given local area. Variation is then used to convert back and forth between magnetic (°M) and true directions (°T) using a simple formula (i.e. °T + °V = °M, if °V is Westerly, or °T - °V = °M, if °V is Easterly).

ezTrap utilizes °T for many of its internal calculations including Latitudes & Longitudes, and also displays °M for Course and Mark Information.

Area Variation can usually be found on a local chart inside a Compass Rose; however, it often has to be adjusted if the chart is older than a few years. If you have access to the internet, you can click on the words Area Variation here or on the spreadsheet to hyperlink to a NOAA website that will provide a good approximation of the Variation in your local area. Please note that ezTrap does not capture the resulting Variation from the website – the user must enter the

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value in decimal degrees (no minutes or seconds) and the Easterly (E) or Westerly (W) attribute. The NOAA and Canadian website URLs are:

NOAA http://www.ngdc.noaa.gov/geomagmodels/IGRFWMM.jsp?defaultModel=WMM
NRC http://geomag.nrcan.gc.ca/apps/mdcal-eng.php

2.9.3 RC Boat Latitude & Longitude

The latitude and longitude of the Race Committee-Signals boat is considered the point of origin for the *ezTrap* calculations. These numbers are entered separately as degrees in whole numbers, decimal minutes, and the letter indicating N or S Latitude, E or W Longitude.

> ***Note:*** *Latitude & Longitude are sometimes expressed as degrees, minutes, and seconds; however ezTrap and most GPS units use decimal minutes – for example 39' 30" is entered as 39.5'.*

ezTrap has been validated for all navigable areas in the world including proper calculation of Latitudes and Longitudes that cross over N/S and/or E/W boundaries.

The internal calculations of Latitude & Longitude numbers utilize at least 10-decimal places of precision; however, the display values are rounded to 3-decimal places.

2.9.4 Fleet Input Values

Information about the fleet that is racing is used by ezTrap to properly size the course. The **Trapezoid, Trap6,** and **RSXtrap** courses can support two different fleets concurrently, and have provision for separate Input Values. **Trap6** can support three disparate fleets. The common parameters are described below:

- **Max. Fleet Size (2-100 boats):** The maximum number of boats in the Fleet is entered. The values are used with the LOAs in the calculation of the length of the Start and Finish Lines.
- **Avg. Boat LOA (2.5-140):** The average boat length overall (LOA) for each Fleet is entered in feet or metres. The values are used along with the Fleet Size for the calculation of the length of the Start and Finish Lines.
- **Avg. Boat Speeds (1-45 kt):** Average boat speeds for Close-Hauled (Beat), Reach, and Run points-of-sail in knots are used to calculate the Estimated Sailing Times by leg, which in turn is used to scale the final course up/down in conjunction with the Target Race Time. The individual speeds can be used by the RO to fine tune the course especially with planing boats and windsurfers where there may be a significant difference in speeds on different points-of-sail for the same wind speed.
- **Avg. Tack Angle (60-130 °):** The Average Tack Angle in degrees refers to twice the relative angle to the wind when the boat is at speed on a close-hauled point-of-sail (POS). Further, the angle should be increased to take Leeway into account. This angle is used to calculate the Distance Sailed on upwind legs, and for the **Trapezoid**, **Trap6**, **RSXtrap** and **Opti** courses, to compute the 3-tack boxes used for spacing the Inner/Outer Courses.

  > ***Note:*** *The angle a boat turns through when tacking is typically larger because the boat speed slows, and the apparent wind direction shifts aft during the turn. As the boat regains speed, the apparent wind direction shifts forward allowing the boat to point higher.*

- **Target Race Time (20-600 minutes):** The Target Race Time is the expected sailing time for the first racer to complete the course, and is used to adjust the overall size of the course. For courses with two W/L legs and two fleets, ezTrap will optimize the length of the W/L legs to meet the Target Race Times of each fleet.

2.9.5 Course Type

The Course Type Input Value allows the selection of a variation of the course. Some courses support multiple pre-programmed variations whereas others only support one type.

2.9.6 Alignment of Marks with Start Line (Pin or MidPt)

All courses and variations except for **Club** have a choice of Pin or Mid-point alignment:

- **Pin:** Alignment of first upwind mark (e.g. Mark 1) with the Starting-Line Pin. Can be used to bias the start towards the Pin end of the line.
- **Mid-Pt:** Alignment of first upwind mark with the mid-point of the Starting-Line.

Other marks that are aligned with the upwind Mark 1 (e.g. Mark 4 on the **Trapezoid** course) are also adjusted with this parameter.

2.9.7 Turning Mark Offset from Start Line (0-6,076)

The distance in feet, metres or nm upwind of the Start Line for a turning mark (e.g. Mark 4 on the **Trapezoid** course) is entered as a whole or decimal number between 0 and 6,076. Typically it is about 0.05 nm or more to allow room for the Fleet to round the mark, but close enough for the RC-Signals Boat to observe the roundings.

Very large offset distances without corresponding long Target Race Times can result in unreasonably short windward/leeward legs from otherwise valid Input Values. ezTrap will provide a Warning message for very small (or negative) W/L legs for some courses.

Note: By setting the turning mark offset windward of the Start Line Distance to zero, and using the Pin alignment option, the turning mark effectively becomes the Start Line Pin.

ROs often use Gates at some marks, especially for larger fleets. ezTrap assumes that the RO and Mark Boats can set and manage these Gates without additional information.

2.9.8 Included Angle at Mark 1 (45-90°)

The Included Angle at Mark 1 is variable for most courses, fixed for the **Opti**, and **Lipton** Challenge Cup courses, and not applicable for the **W/L** courses. The value is entered as a whole number between 45 and 90 degrees. For example, an Included Angle at Mark 1 of 45° results in a relative heading that is 135° off the wind, or a Broad Reach POS. However, with faster boats, the apparent wind angle is much less, and typically ROs set the Included Angle to 45-50° for Keelboats, 55-60° for planing hulls, and 60-70° for catamarans and windsurfers.

2.9.9 Start-Line Length Factor (100-150%)

The Start-Line Length in feet or metres is calculated by ezTrap using the product of Maximum Fleet Size times the Average Boat LOA. This number is then adjusted by the Start-Line Length Factor, rounded up to the nearest 10 units, and shown on the display utilizing the same units as the Average Boat LOA.

The Finish-Line Length is calculated at 25% of the Start-Line Length, and rounded up to the nearest 10 units of length.

2.9.10 Additional Input Values

Additional Input Values are used for some courses and are described in the detailed sections of the manual.

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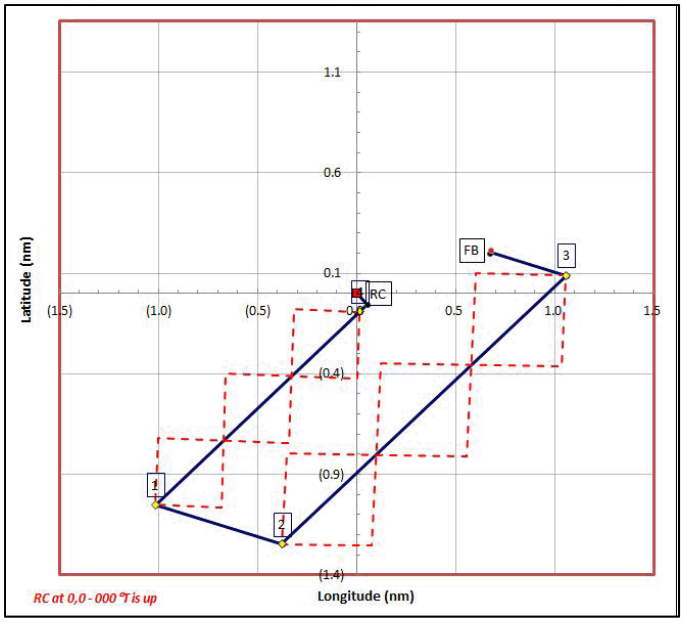
2.10 Course Plot

All ezTrap courses have a graphical course plot. A sample **Trap6** plot is shown, and other sample plots are shown in the detailed sections of the manual.

Each time the Input Values are changed, the resultant Course Plot and information are updated.

The Course Plot utilizes a Cartesian System (x-y plot) with the RC at the origin (x=0, y=0). Horizontal x-axis (Longitude) and vertical y-axis (Latitude) dimensions are shown in ± nm from the origin.

The orientation of the Plot is North (000 °T) as up. Actual Latitude & Longitude numbers are shown in the Mark Information box discussed later.



2.10.1 Plot: Course and Marks

The Course line is drawn in a solid dark color with Marks shown as small diamonds with a yellow center. The Mark Numbers are shown in a small box near each Mark. The RC-Signals Boat is shown as a small square with a red center, located at 0,0 on the plot, and labeled with 'RC' in a small box to the right. The Finish Boat is shown as a smaller red dot, and labeled with 'FB'.

Note: *Wherever possible ezTrap assumes the Finish Boat is downwind or to the right (looking windward) of the Finish Pin in order to make the sail numbers more visible to the Scorers at the Finish.*

2.10.2 Plot: 3-Tack Boxes

ezTrap also plots upwind tacking boxes for the **Trapezoid**, **Trap6**, **RSXtrap,** and **Opti** courses as dashed red lines that illustrate the required clearance inside and outside the Inner and Outer courses. The 3-tack boxes are proportioned according to the respective Tack Angles of each Fleet and length of the leg. The working assumption is that racers will rarely sail an upwind leg with less than 3-tacks therefore defining a practical limit for the spacing of two fleets. Mathematically, boats with the same Tack Angle will have the same Distance Sailed upwind regardless of the number of tacks or boat speed.

2.11 Reset and Make Grid Square Buttons

Excel® uses best-fit auto-scaling for the Course Plot and does not have an automatic method of making the plot square; however, by clicking the Make Grid Square button, an ezTrap custom Visual Basic for Applications (VBA) macro is invoked that will redraw the plot with square gridlines (i.e. the same nm distance for both the x-axis (Longitude) and y-axis (Latitude).

These buttons do not change any Input Values or results. However, if you change any Input Values, it is a good idea to click the Reset button then click the Make Grid Square button to properly update the Plot.

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2.12 *Mark Information*

MARK INFORMATION ID	Name	From RC BRG °M	To RC BRG °M	Dist. nm	Latitude	Longitude
RC	RC Signals Boat	000	000	0.00	20° 39' N	105° 24' W
Pin	Pin-Start Line	286	106	0.08	20° 39.033' N	105° 24.082' W
1	Inner Weather	013	193	0.93	20° 39.872' N	105° 23.644' W
1a	1a Inner Weather	013	193	0.78	20° 39.734' N	105° 23.708' W
2	Outer Weather	344	164	0.83	20° 39.82' N	105° 24.127' W
3	Outer Leeward	234	054	0.71	20° 38.666' N	105° 24.663' W
4	Inner Leeward	336	156	0.07	20° 39.063' N	105° 24.02' W
Fin-Pin	Finish Pin	221	041	0.43	20° 38.71' N	105° 24.346' W
Fin-Boat	Finish Boat	218	038	0.45	20° 38.689' N	105° 24.343' W

Mark Information (**Trap6** shown above) is calculated and updated with any change of an Input Value.

2.12.1 RC Bearings and Distances to Marks

The relative Bearings in °M are shown from the RC-Signals Boat to the Marks paired with reciprocal BRGs and Distances in nm. This information and the Course Information are useful for setting and checking the proper placement of the Marks in case the Mark Boats do not have GPS, or misunderstand the Latitude and Longitude of the Mark, or the Mark is drifting off position.

2.12.2 Latitudes & Longitudes of Marks

The instantaneous calculation of precise Latitudes & Longitudes of all Marks is a key feature of ezTrap. Manual calculations or using a chart plotter will take many minutes at best, and are subject to data entry and other user errors. With Latitudes & Longitudes in hand, and the general availability of GPS for the Race Committee-Signals (RC) and support boats, the task of setting and managing proper Marks becomes significantly faster and easier.

> *"If you don't know where you're going, then you'll end up somewhere else!"*
> - Yogi Berra

As mentioned earlier, the precision of internal calculations is very high – approximately 10-decimal places; however, the display of Latitudes & Longitudes is set to 3-decimal places, which is 0.001' or less than 10-feet. The precision of the results can be easily increased; however, the practical limitations of accurately setting and managing a race course do not appear to require the increased precision.

2.13 *Course Information*

Tri-4

Course Information Leg	Marks	POS	Length (nm) Leg	Dist. Sailed	Est. Sail Time Leg	Cum.	Headings °T	°M
1	Start-1	Upwind	1.09	1.42	*0:14:11*	0:14:11	*076*	*100*
2	1-2	Stbd-Broad Reach	1.44	1.44	*0:05:46*	0:19:57	*326*	*350*
3	2-3	Port-Broad Reach	1.44	1.44	*0:05:46*	0:25:43	*186*	*210*
4	3-1	Upwind	0.99	1.29	*0:12:53*	0:38:36	*076*	*100*
5	1-3	Downwind	0.99	0.99	*0:05:55*	0:44:31	*256*	*280*
6	3-Finish	Upwind Finish	1.19	1.55	*0:15:29*	*14:24:00*	*076*	*100*
		Totals	7.13	8.12	*1:00:00*			

POS Stats	nm	%	Time	%Time
Beat	4.25	52%	0:42:33	71%
Run	0.99	12%	0:05:55	10%
Reach	2.88	35%	0:11:32	19%
Total	**8.12**	**100.0%**	***1:00:00***	**100%**

ezTrap provides a display of Course Information for each leg including the marks involved, point-of-sail, straight line and Distance Sailed lengths in nm, Estimated Sailing Time and Cumulative Time by Leg, and Headings in both degrees magnetic and true.

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2.13.1 Headings

The Headings (°T and °M) are the actual headings for each leg, as computed from the Wind Direction, Variation, and other course information, but are not necessarily the HDGs the racers will utilize.

Note: At this time ezTrap does not have separate Input Values for the Set and Drift of currents affecting the course. The RO is limited to changes in the Wind Direction to counteract the effects of currents.

2.13.2 Course Lengths (nm)

ezTrap computes the length of individual legs, distance sailed, and total course length based on the Input Values, especially Tack Angle, Target Race Times, and Average Speeds for Close-hauled, Reach, and Run points-of-sail.

If a Course needs adjustment, the RO should monitor the actual vs. estimated sailing times by leg then adjust the Tack Angle and/or Average Speeds accordingly. Then, by changing these Input Values, the subsequent course should better meet the Target Race Time.

Since, **Trapezoid,** **Trap6,** and **RSXtrap** courses are shared by two Fleets with potentially different characteristics, the adjusted lengths of the windward/leeward legs are calculated to meet the respective Target Race Times using the mathematical technique of solving two simultaneous equations with two unknowns.

2.13.3 Point-of-Sail Statistics

ezTrap provides a summary of the percent of Total Distance Sailed by point-of-sail (POS), including Beat (i.e. Close-hauled), Reach, and Run. Since many different Input Values change the geometry and size of the course, the RO may find these statistics useful in optimizing the course.

Note: ezTrap users have a great deal of control over the final geometry of the course, and will quickly see the effects of changing the Input Values. If you see the need for different or additional controls, please let us know.

2.13.4 More on Distance Sailed

For a given Average Tack Angle (i.e. twice the Close-Hauled angle), the Distance Sailed on the windward leg is mathematically the same regardless of the number of tacks or boat speed. For example, 90° yields a ratio of 1.414 (i.e. square root of 2) times the linear length of the windward leg. As the Average Tack Angle gets smaller (i.e. sailing closer to the wind), the Distance Sailed gets smaller and vice versa.

In practice, the Distance Sailed can vary with the skill of the racer, individual boat tack angles, leeway, and the presence of a current. And, because of the inefficiencies with each tack, the Distance Sailed will increase in proportion to the number of tacks on the leg. However, with a one-design fleet the Average Tack Angle may not be as important as Average Boat Speed in adjusting the course geometry and size to meet a Target Race Time.

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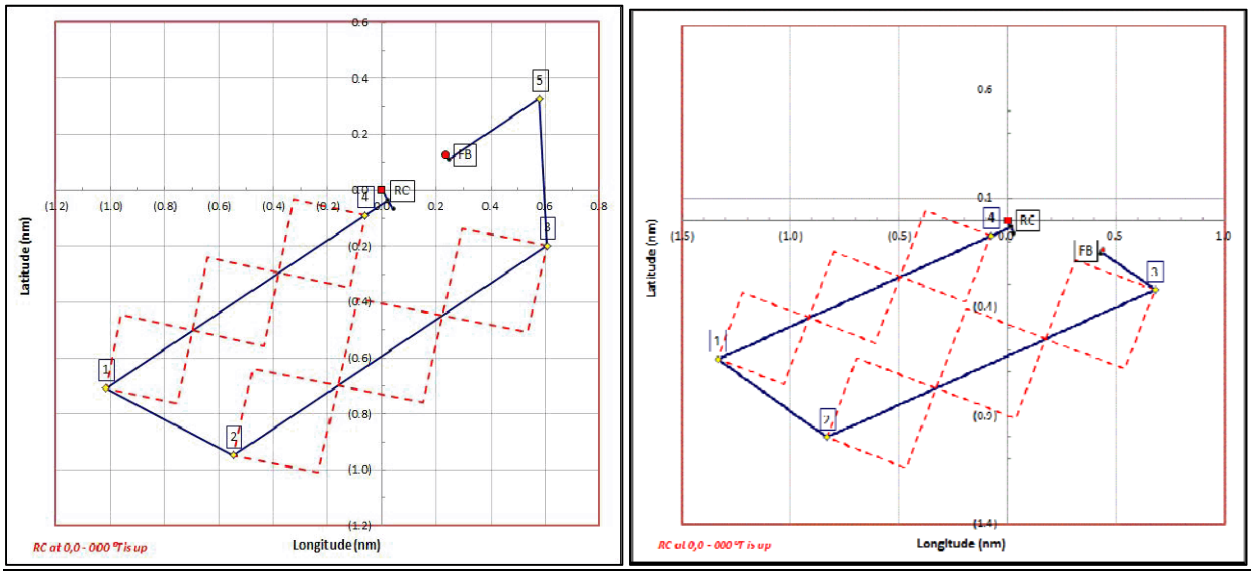
3. Trapezoid Courses (Trapezoid and Trap6)

The Trapezoid family of ezTrap has four courses with the tab names: **Trapezoid**, **Trap-6,** **Opti**, and **RSXtrap**. The first two are discussed in this section, and the others in separate sections later.



The **Trapezoid** course has 7-legs and 5-marks, and is intended to be compliant with the ISAF Olympic Trapezoid Course. Although it is possible to finish at the start-line, some ROs prefer to have a separate Finish Boat and Mark downwind of the Start-Line. The sequences of the **Trapezoid** courses are:

- Inner: Start-1-4-1-2-3-5-Finish
- Outer: Start-1-2-3-2-3-5-Finish

The **Trap6** course is considered to be the flagship trapezoid course and has 6-legs, 4-marks, and a separate Finish Boat. The finish leg is adjustable, in both angle and length to allow the RO to keep the finishing fleet from interfering with a starting fleet. The sequences of the **Trap6** courses are:

- Inner: Start-1-4-1-2-3-Finish
- Outer: Start-1-2-3-2-3-Finish

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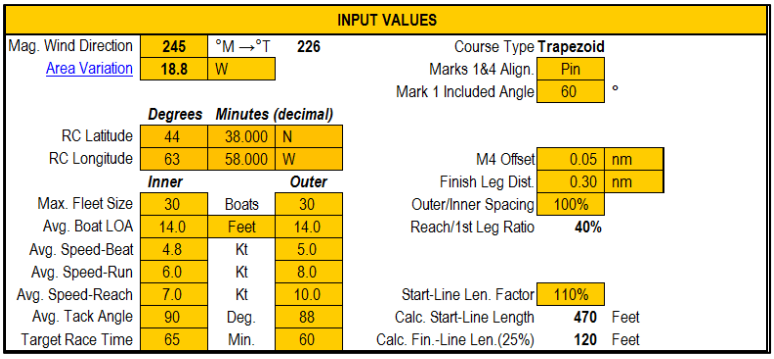
3.1 Trapezoid Input Values

The common ezTrap Input Values are described in the Getting Started section of the manual.

This section describes the Input Values that are unique to the 7-leg **Trapezoid** course


INPUT VALUES
Mag. Wind Direction 245 °M →°T 226
Area Variation 18.8 W
Course Type Trapezoid
Marks 1&4 Align. Pin
Mark 1 Included Angle 60 °
Degrees Minutes (decimal)
RC Latitude 44 38.000 N
RC Longitude 63 58.000 W
M4 Offset 0.05 nm
Finish Leg Dist. 0.30 nm
Inner Outer
Max. Fleet Size 30 Boats 30
Avg. Boat LOA 14.0 Feet 14.0
Avg. Speed-Beat 4.8 Kt 5.0
Avg. Speed-Run 6.0 Kt 8.0
Avg. Speed-Reach 7.0 Kt 10.0
Outer/Inner Spacing 100%
Reach/1st Leg Ratio 40%
Avg. Tack Angle 90 Deg. 88
Target Race Time 65 Min. 60
Start-Line Len. Factor 110%
Calc. Start-Line Length 470 Feet
Calc. Fin.-Line Len.(25%) 120 Feet

3.1.1 Finish Leg Distance (0.05-6,076)

The Finish Leg Distance in feet, metres or nm between Mark 5 and the Finish Line is entered as a whole or decimal number between 0.05 and 6,076. The final leg is not scaled up/down with the other factors, and the RO can control the location of the finish area with this parameter. If the RO wishes to set the Finish Line on the Start Line, the parameter can be easily varied until the Course Plot shows the desired length.

3.1.2 Outer/Inner Spacing Factor (50-250%)

ezTrap utilizes the premise that the Reach between the Inner/Outer Course is not as tactical as the windward/leeward legs, and minimizes the separation of the two courses without intentionally causing upwind tacking interference between the two Fleets.

3-Tacks are assumed when calculating the potential interference between Fleets. The spacing is then determined by the length of the windward/leeward legs, and the Tack Angles of the two Fleets. The calculated spacing may be adjusted with the Outer/Inner Spacing Factor as needed.

A 100% value will result in the 3-tack boxes just touching - less than 100% may result in some interference - and greater than 100% will create more space between the Fleets. Some interference may still occur with boats that sail the windward legs in 1-2 tacks, or that sail past the lay line.

As the windward/leeward legs get longer (e.g. changes in Target Race Times), the spacing between the two Fleets gets wider.

3.1.3 Ratio of Reach to 1st Leg Length (Calculated %)

Some ROs prefer to have the length of the Reach be a certain ratio to the length of the first leg (e.g. 2/3 or 66%). This Ratio is calculated and displayed by ezTrap enabling the RO to make optional adjustments to the Outer/Inner Spacing Factor until the desired ratio is achieved.

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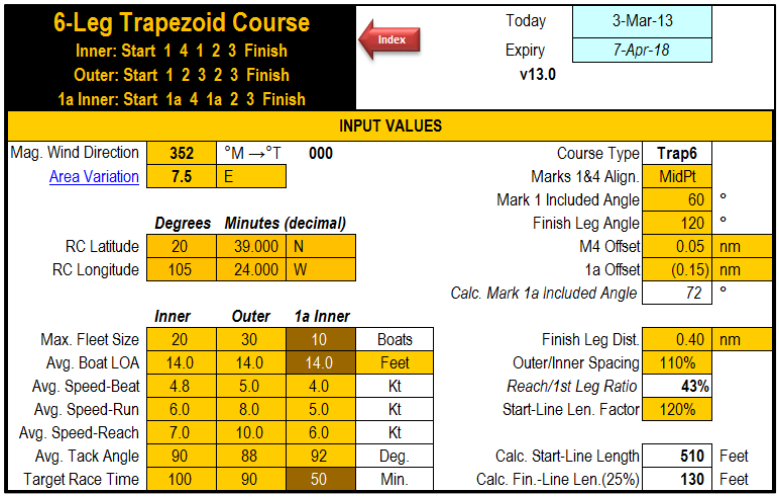
3.2 *Trap6 Input Values*

The common ezTrap Input Values are described in the Getting Started section of the manual. This section describes the Input Values that are unique to the 6-leg **Trap6** course.

The only differences between the **Trapezoid** and **Trap6** courses are the addition of the 'Finish Leg Angle' and '1a Offset' Input Values.


6-Leg Trapezoid Course
Inner: Start 1 4 1 2 3 Finish
Outer: Start 1 2 3 2 3 Finish
1a Inner: Start 1a 4 1a 2 3 Finish
Index
Today 3-Mar-13
Expiry 7-Apr-18
v13.0
INPUT VALUES
Mag. Wind Direction 352 °M →°T 000
Area Variation 7.5 E
Course Type Trap6
Marks 1&4 Align. MidPt
Mark 1 Included Angle 60 °
Finish Leg Angle 120 °
M4 Offset 0.05 nm
1a Offset (0.15) nm
Calc. Mark 1a Included Angle 72 °
Degrees Minutes (decimal)
RC Latitude 20 39.000 N
RC Longitude 105 24.000 W
Inner Outer 1a Inner
Max. Fleet Size 20 30 10 Boats
Avg. Boat LOA 14.0 14.0 14.0 Feet
Avg. Speed-Beat 4.8 5.0 4.0 Kt
Avg. Speed-Run 6.0 8.0 5.0 Kt
Avg. Speed-Reach 7.0 10.0 6.0 Kt
Avg. Tack Angle 90 88 92 Deg.
Target Race Time 100 90 50 Min.
Finish Leg Dist. 0.40 nm
Outer/Inner Spacing 110%
Reach/1st Leg Ratio 43%
Start-Line Len. Factor 120%
Calc. Start-Line Length 510 Feet
Calc. Fin.-Line Len.(25%) 130 Feet

3.2.1 Finish Leg Angle (45-135°) - Trap6 Only

Both Fleets finish the **Trap6** course with a Gybe around Mark 3 to the Finish Line. The Finish Turn Angle is the turning angle to Port from the downwind run to the finish leg, and is entered as a whole number between 45 and 135 degrees.

3.2.2 Finish Leg Distance (0.05-6,076)

For **Trap6**, Finish Leg Distance in feet, metres or nm between Mark 3 and the Finish Line is entered as a whole or decimal number between 0.05 and 6,076. The final leg is not scaled up/down with the other factors, and the RO can control the location of the finish area with this parameter and the Finish Leg Angle.

nm	Metres	Feet
1.00	1,852	6,076
0.02	30	100
0.08	152	500
0.16	305	1,000
0.03	50	164
0.05	100	328
0.08	150	492
0.05	93	304
0.10	185	608
0.15	278	911

3.2.3 Outer/Inner Spacing Factor (50-250%)

ezTrap utilizes the premise that the Reach between the Inner/Outer Course is not as tactical as the windward/leeward legs, and minimizes the separation of the two courses without intentionally causing upwind tacking interference between the two Fleets.

3-Tacks are assumed when calculating the potential interference between Fleets. The spacing is then determined by the length of the windward/leeward legs, and the Tack Angles of the two Fleets. The calculated spacing may be adjusted with the Outer/Inner Spacing Factor as needed.

A 100% value will result in the 3-tack boxes just touching - less than 100% may result in some interference - and greater than 100% will create more space between the Fleets. Some interference may still occur with boats that sail the windward legs in 1-2 tacks, or that sail past the lay line.

As the windward/leeward legs get longer (e.g. changes in Target Race Times), the spacing between the two Fleets gets wider.

3.2.4 Ratio of Reach to 1st Leg Length (Calculated %)

Some ROs prefer to have the length of the Reach to be a certain ratio to the length of the first leg (e.g. 2/3 or 66%). This Ratio is calculated and displayed by ezTrap enabling the RO to make optional adjustments to the Outer/Inner Spacing Factor until the desired ratio is achieved.

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3.2.5 Mark 1a Offset (Trap6)

Trap6 will optionally support a third fleet with the use of an optional 1a Mark above or below Mark 1. The offset distance can be entered as a ± 0-6,076 decimal number for feet, metres, or nm. Typically the 1a Mark is set below Mark 1, which requires a negative value such as -.10 nm. When set to zero, Marks 1a and 1 are effectively the same.

Separate Input Values and Course Information Display are provided for the third fleet that uses the 1a Option. The Average Speeds and Tack Angle are used to calculate the Estimated Sailing and Cumulate Time by Leg; however, the number of Boats, Average LOA, and Target Race Time Input Values are for reference only and are not used for any calculations.

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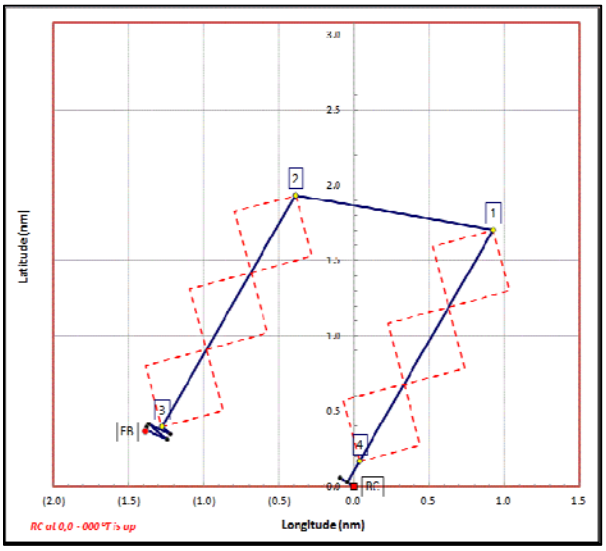
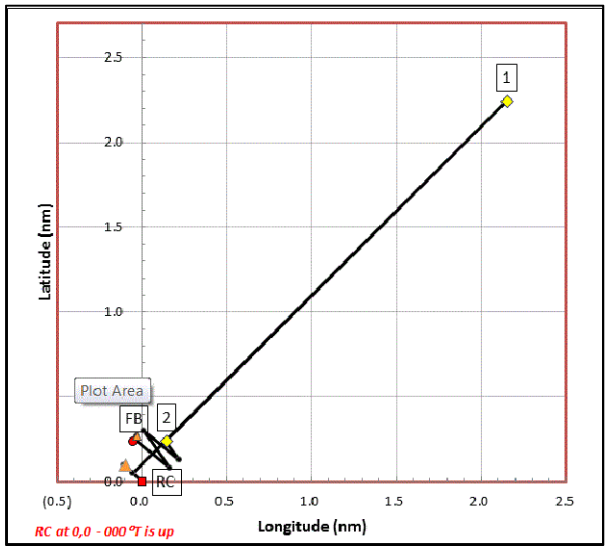
4. RS:X Windsurfer Slalom Courses (RSXtrap & RSXls)

The ezTrap RS:X Windsurfer Trapezoid **RSXtrap** and Windward/Leeward Slalom **RSXls** courses are illustrated below:





The **RSXtrap** course (shown on the left) is a classic trapezoid course with a slalom finish that can support two different fleets. It has three variations including 1, 2, or 3 W/L legs. The **RSXls** course is a classical windward-leeward course with a slalom finish. It also has three variations.

The common ezTrap Input Values are described in the Getting Started section of the manual.

4.1 RSX Input Values

The unique Input Values for **RSXtrap** are similar to the **Trapezoid** and **Trap6** courses but with the addition of the Initial Slalom Angle and Slalom Leg Distance. These two additions are also used for the **RSXls** course.

RS:X Trapezoid Slalom Course

Inner: Start-1-4-1-4-1-2-3-S123-Finish

Outer: Start-1-2-3-2-3-2-3-S123-Finish

Index

Today 3-Mar-13

Expiry 7-Apr-18

v13.0

INPUT VALUES

Mag. Wind Direction	351	°M → °T	000	Course Type	RSX-2	
Area Variation	9.0	E		Marks 1&4 Align.	MidPt	
				Mark 1 Included Angle	70	°
	Degrees	Minutes (decimal)		Initial Slalom Angle	16	°
RC Latitude	52	45.500	N			
RC Longitude	5	2.000	W	M4 Offset	0.05	nm
	Inner		Outer	Slalom Leg Dist.	300	Metres
Max. Fleet Size	60	Boats	50			
Avg. Boat LOA	2.9	Metres	2.9	Outer/Inner Spacing	115%	
Avg. Speed-Beat	6.0	Kt	8.0	Reach/1st Leg Ratio	48%	
Avg. Speed-Run	12.0	Kt	14.0			
Avg. Speed-Reach	15.0	Kt	16.0	Start-Line Len. Factor	110%	
Avg. Tack Angle	92	Deg.	88	Calc. Start-Line Length	190	Metres
Target Race Time	60	Min.	55	Calc. Fin.-Line Len.(25%)	50	Metres

4.1.1 Course Type

The user can select one of three variations of the RSX Courses from the drop down list values for once, twice, and three times around the W/L legs of the course (6, 8, or 10 legs).

The Course Types and sequences of the **RSXtrap** course are:

- RSX-1
  - Inner: Start-1-4-1-2-3-S123-Finish
  - Outer: Start-1-2-3-2-3-S123-Finish
- RSX-2
  - Inner: Start-1-4-1-4-1-2-3-S123-Finish
  - Outer: Start-1-2-3-2-3-2-3-S123-Finish
- RSX-3

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- Inner: Start-1-4-1-4-1-4-1-2-3-S123-Finish
- Outer: Start-1-2-3-2-3-2-3-2-3-S123-Finish

The Course Types and sequences of the **RSXls** course are:

- LS-1 (6-legs): Start-1-2-S123-Finish
- LS-2 (8-legs): Start-1-2-1-2-S123-Finish
- LS-3 (10-legs): Start-1-2-1-2-S123-Finish

4.1.2 Initial Slalom Angle (10-30°)

This angle is used to position the first slalom mark (S1). The Initial Slalom Angle + 90° is the internal angle at M3 or the total degrees off the wind. From the windsurfer's point of view, the turn to port from the downwind run to S1 is equivalent to 90° less the Initial Slalom Angle. The typical value for the Initial Slalom Angle is 10°, which results in a Reach 100° off the wind, or a turn to port at M3 of 80°.

The subsequent turns to S2, S3, and the Finish are equal to 180° less 150% of the Initial Slalom Angle. For example, for an Initial Slalom Angle of 16° (shown above) the turns at S1, S2, and S3 would be 156° (180° less 24°).

4.1.3 Mark Offset from Start Line (0-6,076)

The distance in feet, metres or nm upwind of the Start Line for a turning mark (e.g. Mark 4 on the **RSXtrap** course and M2 on the **RSXls** course) is entered as a positive whole or decimal number between 0 - 6,076. Typically it is about 0.05 nm or more to allow room for the Fleet to round the mark, but close enough for the RC-Signals Boat to observe the roundings.

Very large offset distances without corresponding long Target Race Times can result in unreasonably short windward/leeward legs from otherwise valid Input Values.

Further, with a 'Pin' alignment and a zero offset, the Start Line Pin effectively becomes the mark, which can be desirable when there are limited marks or mark boats.

Typically, the RSXls M2 offset is larger to allow the slalom legs and finish to occur windward of the Start Line.

4.1.4 Slalom Leg Distance (0.05-6,076)

The Slalom Leg Distance in feet, metres or nm between Mark 3 and the Finish Line is entered as a whole or decimal number between 0.05 - 6,076.

The first slalom leg (M3 to S1) is calculated at 50% of the value. The slalom legs are not scaled up/down with the other factors.

nm	Metres	Feet
1.00	1,852	6,076
0.02	30	100
0.08	152	500
0.16	305	1,000
0.03	50	164
0.05	100	328
0.08	150	492
0.05	93	304
0.10	185	608
0.15	278	911

4.1.5 Outer/Inner Spacing Factor (50-250%)

ezTrap utilizes the premise that the Reach between the **RSXtrap** Inner/Outer Course is not as tactical as the windward/leeward legs, and minimizes the separation of the two courses without intentionally causing upwind tacking interference between the two Fleets.

3-Tacks are assumed when calculating the potential interference between Fleets. The spacing is then determined by the length of the windward/leeward legs, and the Tack Angles of the two Fleets. The calculated spacing may be adjusted with the Outer/Inner Spacing Factor as needed.

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A 100% value will result in the 3-tack boxes just touching - less than 100% may result in some interference - and greater than 100% will create more space between the Fleets. Some interference may still occur with boats that sail the windward legs in 1-2 tacks, or that sail past the lay line.

As the windward/leeward legs get longer (e.g. changes in Target Race Times), the spacing between the two Fleets gets wider.

4.1.6 Ratio of Reach to 1st Leg Length (Calculated %)

Some ROs prefer to have the length of the Reach between M1 and M2 of the **RSXtrap** course to be a certain ratio to the length of the M4-M1 leg – 75% is typical. This Ratio is calculated and displayed by ezTrap enabling the RO to make optional adjustments to the Outer/Inner Spacing Factor until the desired ratio is achieved.

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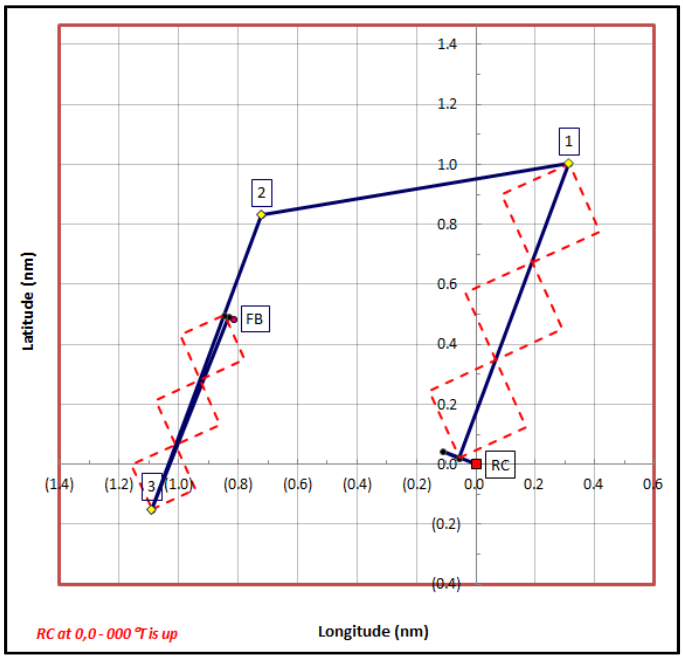
5. Optimist Course (Opti)

The Optimist Course is intended to be compliant with the International Opti Worlds course. No other variations are supported at this time; however, some race officers have used the **Trapezoid**, **Trap6**, and other ezTrap courses for Optimists.

The Opti Worlds Course has 4-legs, 3-marks, and separate Start and Finish Lines. The sequence for the course is: **Start-1-2-3-Finish.**

Although the size of the course can vary with several parameters, the geometry is somewhat fixed using the following attributes:

- The first three legs are the same length with the Included Angle at Mark 1 = 60°;
- The third leg is parallel to the first leg;
- The length of the fourth leg (i.e. upwind finish from Mark 3 to the Finish-Line) is controlled by the RO as a percentage (50-150%) of the 3rd leg, and is also parallel to the first and third legs.



5.1 Optimist Course Input Values

The common ezTrap Input Values are described in the Getting Started section of the manual. This section describes the Input Value that is unique to the **Opti** course – Finish Leg Distance.

5.1.1 Finish Leg Distance (50-150% of third leg)

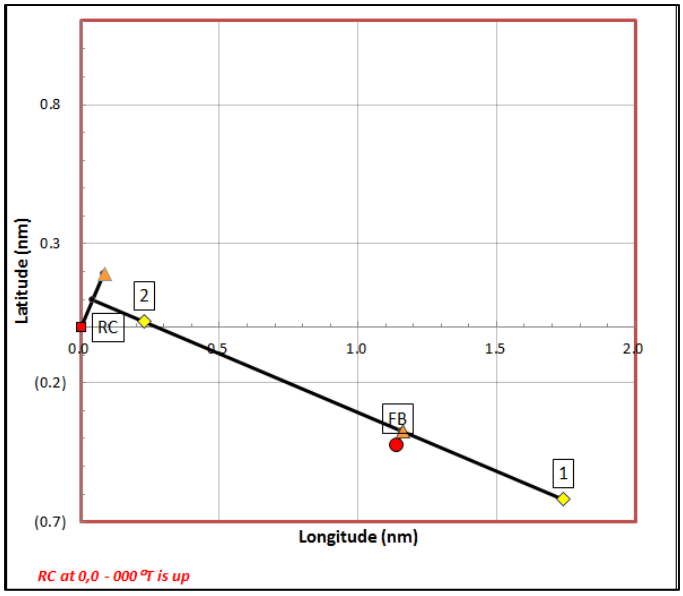
For the **Opti** course, the final windward leg distance is calculated as a percentage of the length of the third leg, which is also the same distance as the first leg and the Reach. The length of the final leg is scaled up/down with the other factors but the same proportion is maintained. Note that a value of 100% will result in the Finish-Line Pin having the same Latitude & Longitude as Mark 2.

Optimist Course				Index	Today	3-Mar-13
4-Legs: Start-1-2-3-Finish					Expiry	7-Apr-18
					v13.0	
INPUT VALUES						
Mag. Wind Direction	045	°M →°T	021		Course Type	Opti
Area Variation	24.4	W			Mark 1 Alignment	MidPt
	Degrees	*Minutes (decimal)*				
RC Latitude	33	51.000	S		Finish Leg Dist. (% Mk 2-3)	66%
RC Longitude	18	24.000	E			
Max. Fleet Size	20	Boats				
Avg. Boat LOA	10.0	Metres			Target Race Time	60 Min.
Avg. Speed-Beat	4.0	Kt				
Avg. Speed-Run	5.0	Kt			Start-Line Len. Factor	110%
Avg. Speed-Reach	6.0	Kt			Calc. Start-Line Length	230 Metres
Avg. Tack Angle	90	Deg.			Calc. Finish-Line Len.	60 Metres

6. Windward/Leeward Course (W/L)

The ezTrap Windward/Leeward Course is described in this section. The 4-leg W/L variation (WL4) is available as a free download.

The W/L course supports 5-variations, which are compliant with the ISAF Courses, and 3-variations (WL3, WL5 and WL7) that are equivalent to the Lipton Challenge Cup "S" courses: S-1, S-2, and S-3.



6.1 Windward/Leeward Course Input Values

The common ezTrap Input Values are described in the Getting Started section of the manual.

This section described the Input Values that are unique to the **W/L** course – Course Types, and % Finish Distances.

INPUT VALUES						
Mag. Wind Direction	090	°M →°T	113	Course Type	WL-5	
Area Variation	22.9	E		Marks 1&2 Align.	MidPt	
	Degrees	*Minutes (decimal)*		M2 Offset	0.20	nm
RC Latitude	41	16.000	S	WL3,5&7 % Fin Dist.	62%	%
RC Longitude	174	49.000	E			
				Target Race Time	60	Min.
Max. Fleet Size	60	Boats				
Avg. Boat LOA	14.0	Feet				
Avg. Speed-Beat	8.0	Kt		Start-Line Len. Factor	150%	
Avg. Speed-Run	16.0	Kt		Calc. Start-Line Length	1,270	Feet
Avg. Tack Angle	90	Deg.		Calc. Fin.-Line Len.	320	Feet

6.1.1 Course Types

Five variations of the Windward/Leeward Course are supported, and can be selected from a Drop-down List:

- **WL-3** is a 3-leg course with an upwind Finish. The distance of the last upwind leg is calculated as a % of the W/L leg length. This is also used to plan the Lipton Challenge Cup "S-1", once around course.
- **WL-4** is a 4-leg course with the Finish at the Start Line. This variation is also available as a FREE download.
- **WL-5** is a 5-leg course with an upwind Finish. The distance of the last upwind leg is calculated as a % of the W/L leg length. This is also used to plan the Lipton Challenge Cup "S-2", twice around course.
- **WL-6** is a 6-leg course with the Finish at the Start Line.
- **WL-7** is a 7-leg course with an upwind Finish. The distance of the last upwind leg is calculated as a % of the W/L leg length. This is also used to plan the Lipton Challenge Cup "S-3", three times around course.

6.1.2 WL-3, WL-5 & WL-7 Finish Leg Distance (20-150% of W/L Leg)

For the **WL-3**, **WL-5** & **WL-7** courses, the final windward leg distance is extended upwind of Mark 2 based on a percentage of the W/L leg distance. For example, 100% is the equivalent of having the Finish Pin at M1. The final leg is also included in the calculation of the M2-M1 W/L Leg distance to meet the Target Race Time.

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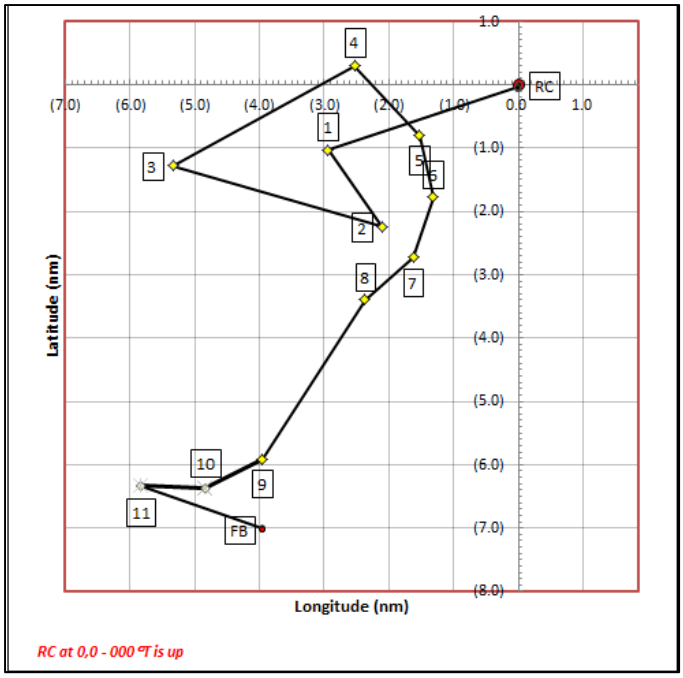
7. Yacht Club Course (Club)

The Yacht Club Course is the do-it-yourself custom course design of the ezTrap family, and can often be used to duplicate other courses or add variations.

The Club Course allows the RO to design a custom course of up to 12-legs utilizing simple parameters of relative turns and distance. Further, the Club course can make use of predefined fixed marks that are typically part of many yacht clubs 'round the buoys' race courses.

This Yacht Club course plot shown is an example of a course that uses six fixed marks, and six moveable marks. It is based on the Input Values that are used in the Fixed Marks Table and Course Table examples that follow. However, a **Club** course can be composed of any mixture of calculated or fixed marks.



7.1 Yacht Club Input Values

The common ezTrap Input Values are described in the Getting Started section of the manual. This section describes the Input Values that are unique to the Yacht Club Course.

INPUT VALUES						
Mag. Wind Direction	300	°M→°T	281			
Area Variation	18.8	W		Course Name:	SMAKR-4	
	Degrees	Minutes (decimal)				
RC Latitude	44	38.001	N			
RC Longitude	63	55.100	W			
Max. Fleet Size	30	Boats		Start-Line Len. Factor	100%	
Avg. Boat LOA	14.0	Feet		Calc. Start-Line Length	430	Feet
Avg. Boat Speed-Beat	6.0	Kt		Calc. Fin.-Line Len.	110	Feet
Avg. Boat Speed-Run	5.0	Kt				
Avg. Boat Speed-Reach	7.5	Kt				
Avg. Tack Angle	90	Deg.				

7.1.1 Course Name

The Yacht Club Course allows the user to enter a name for the course that will show on the display and any printouts; however, the Course Name is not used for any other purpose.

7.2 Pre-defined Fixed Marks Table

ezTrap allows up to 12-fixed marks to be entered in the Fixed Marks Table. The marks must be defined in the Table in order to be used as Fixed Marks in designing the course. The table does not need to be complete or in any particular sequence, and the user does not have to use any or all of the pre-defined marks. Further, the user can create numerous courses from the same Fixed Marks Table, and save the courses with unique names to be used at a later date. The sample Fixed Marks Table shown is from our home sailing club, and supports over 40-courses in our local waters that have been used for decades.

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Fixed Marks Table		Latitude			Longitude			
ID	Name	Degrees	Minutes (decimal)		Degrees	Minutes (decimal)		
FM1	SMSC-N	44	38.020	N	63	55.170	W	
FM2	Croucher-W	44	37.950	N	63	57.500	W	
FM3	Croucher-E	44	37.910	N	63	57.400	W	
FM4	Alpha	44	37.200	N	63	57.250	W	
FM5	Bravo	44	38.300	N	63	58.650	W	
FM6	Charlie	44	36.750	N	63	59.900	W	
FM7	Delta	44	39.200	N	63	56.250	W	
FM8	Echo (DA58)	44	35.760	N	63	58.060	W	
FM9	Foxtrot (DY52)	44	36.720	N	64	2.600	W	
FM10	Golf (DP51)	44	32.090	N	64	0.650	W	
FM11							W	Lat Err
FM12				N				Long Err

7.2.1 Fixed Mark ID

Each entry has a unique ID (e.g. FM2) that is also used in designing the course. The sequence of marks in the table is not important, and entries may be empty if they are not be used.

7.2.2 Fixed Mark Name

Each mark entered can have an alphanumeric name that is also used in the Mark Information Display. Approximately 8-characters will be visible in the Fixed Marks Table, and 14-16 characters in the Mark Information display. No editing is performed.

7.2.3 Fixed Mark Latitude and Longitude

Latitudes and Longitudes for the Fixed Marks Table follow the same rules as when entering the RC Latitude & Longitude. If there is no entry or the N or S, or W or E are missing, then an error message ***Lat Err*** or ***Long Err*** will be displayed. If a N or S and W or E are present, but no degrees or minutes, the values are assumed to be zero. Even with the ***Lat Err*** message or zero values, ezTrap will continue to work; however, if the Fixed Mark is used in the course the results may be undesirable.

7.3 Yacht Club Course Table

ezTrap allows up to 12-legs in a customized Club Course. Each leg has a unique ID (e.g. 1, 2, 3…) and is designated 'F' for Fixed Mark, or 'C' for a calculated leg. The RC-Signals Boat location is the assumed fixed starting point.

7.3.1 Calculated Legs ('C')

For a calculated leg, ezTrap takes the previous leg's ending position then calculates a new ending position using the Turn and NM parameters. Turns are changes in headings in relative degrees where turning to port is negative, and starboard positive. The initial leg (#1) is assumed to be directly up-wind unless modified by the relative heading of the Turn.

In the foregoing example the 1st leg will produce a 30 degree turn to Port from the initial Wind Direction, and for a length of 3.10nm.

The Mark ID column can be used optionally by the RO to name the mark (e.g. M1) at the end of the leg. If blank, the name defaults to 'CM' for calculated mark. The Mark Name is also shown in the Mark Information and Course Information display.

Leg ID	F or C	Mark ID	Turn	nm
0	F	RC	0	-
1	C		-30	3.10
2	F	FM8		
3	F	FM9		
4	F	FM5		
5	F	FM4		
6	C	ct1	30	1.00
7	C	ct2	30	1.00
8	C	ct3	30	1.00
9	F	FM10		
10	C	ct5	30	1.00
11	C	ct6	30	1.00
12	F	FM12		

7.3.2 Fixed Legs ('F')

For a leg using a Fixed Mark the RO must enter one of the pre-defined values (FM#) from the Fixed Marks Table. The Turn and NM columns are then blacked out and are not used. The leg starts from the previous leg's position and ends at the

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specified Fixed Mark. ezTrap calculates the heading and distance between these two points.

No other edits or logic are applied; so if there is an error in the Fixed Marks Table the results may not be as desired. Further, unlike other ezTrap Courses, there is no provision in the Club Course for automatically re-sizing the course to meet Target Race Times.

7.3.3 Course Information

SMAKR-4	Course Information		Length (nm)		Est. Sail Time		Headings	
Leg	Marks	P.O.S.	Leg	Dist.	Leg	Cum.	°T	°M
1	CMark	Beat	3.10	4.38	*0:43:50*	*0:43:50*	251	270
2	FM8	B.Reach	1.47	1.47	*0:11:44*	*0:55:34*	145	164
3	FM9	Beat	3.37	4.77	*0:47:43*	*1:43:17*	287	305
4	FM5	B.Reach	3.23	3.23	*0:25:49*	*2:09:06*	061	079
5	FM4	B.Reach	1.49	1.49	*0:11:53*	*2:20:59*	138	157
6	ct1	Reach	1.00	1.00	*0:08:00*	*2:28:59*	168	187
7	ct2	Reach	1.00	1.00	*0:08:00*	*2:36:59*	198	217
8	ct3	C.Reach	1.00	1.00	*0:08:00*	*2:44:59*	228	247
9	FM10	C.Reach	2.97	2.97	*0:23:47*	*3:08:46*	212	231
10	ct5	Beat	1.00	1.41	*0:14:09*	*3:22:55*	242	261
11	ct6	Beat	1.00	1.41	*0:14:09*	*3:37:04*	272	291
12	FM12	Reach	2.00	2.00	*0:16:00*	*3:53:04*	000	019
		Totals	**22.62**	**26.13**	*3:53:04*			

POS	nm	%nm	Time	%Time
Close Hauled	11.98	46%	*1:59:51*	51%
Close Reach	3.97	15%	*0:31:47*	14%
Reach	4.00	15%	*0:32:00*	14%
Broad Reach	6.18	24%	*0:49:26*	21%
Run	-	0%	*0:00:00*	0%
	26.13	**100%**	***3:53:04***	**100%**

The Yacht Club Course Information display is similar to other ezTrap displays, and includes the Name of the course given by the user, and the calculated POS (point-of-sail) for each leg.

7.3.4 Point-of-sail Statistics

ezTrap provides a summary of the percent of Total Distance Sailed (nm) by POS, including Close-hauled, Close-reach, Reach, Broad-reach, and Run. Since many different Input Values change the geometry and size of the course, the RO may find these statistics useful in optimizing the course. ezTrap uses the following table of relative heading thresholds to determine POS statistics:

0	Close Hauled (Beat)
45	Close Reach
70	Reach
120	Broad Reach
170	Run

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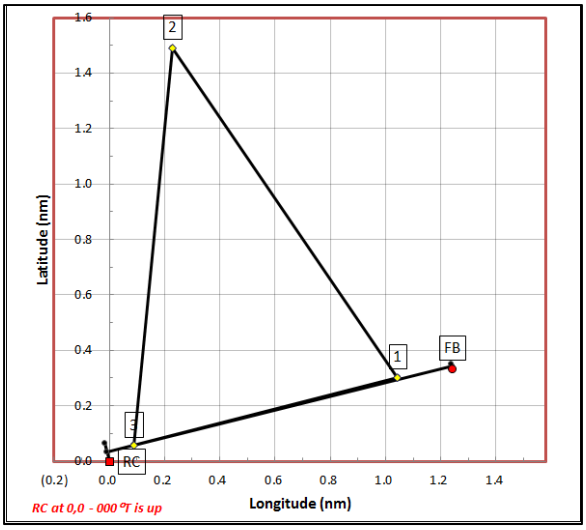
8. Triangle Course (Triangle)

The Triangle Course is intended to be compliant with the ISAF Olympic Triangle Course. It contains three variations: Tri-2, Tri-3, and Tri-4 (shown).



The sequences of the three variations are:

- Tri-2: Start-1-2-Pin-1-Finish at Start
- Tri-3: Start-1-2-3-1-3-Finish at Start
- Tri-4: Start-1-2-3-1-3-Finish Upwind

Additional ezTrap triangle courses and variations are available in the Lipton Challenge Cup Family – see the descriptions of the Lipton "T" and "O" courses.

8.1 Triangle Course Input Values

The common ezTrap Input Values are described in the Getting Started section of the manual.

This section described the Input Values that are unique to the **Tri-4** course – Course Type and **Tri-4** Finish Leg Distance

Triangle Course
6-Leg: Start-1-2-3-1-3-Finish Upwind

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v13.0

INPUT VALUES						
Mag. Wind Direction	100	°M →°T	076	Course Type	Tri-4	
Area Variation	24.4	W		Marks 1&3 Align.	MidPt	
				Mark 1 Included Angle	60	°
	Degrees	Minutes (decimal)				
RC Latitude	33	51.000	S	Tri-3&4 M3 Offset	0.10	nm
RC Longitude	18	24.000	E	Tri-4 M1-Fin Dist.	0.20	nm
Max. Fleet Size	30	Boats				
Avg. Boat LOA	12.0	Feet		Target Race Time	60	Min.
Avg. Speed-Beat	6.0	Kt				
Avg. Speed-Run	10.0	Kt		Start-Line Len. Factor	110%	
Avg. Speed-Reach	15.0	Kt		Calc. Start-Line Length	400	Feet
Avg. Tack Angle	80	Deg.		Calc. Fin.-Line Len.	110	Feet

8.1.1 Course Types (Tri-2, Tri-3 or Tri-4)

Three variations of the Triangle Course are supported, and can be selected from a Drop-down List:

Tri-2 is a 2-Mark, 5-Leg Triangle course where the Start-Line Pin also serves as the 3rd Mark.

Tri-3 is the classic 3-Mark, 5-Leg Triangle Course. Both Tri-2 & Tri-3 courses finish at the Start-Line.

Tri-4 (shown) adds a 6th leg that is upwind of the windward Mark, and requires a separate Finish Line.

8.1.2 Tri-4 Finish Leg Distance (0.05-6,076)

For the **Tri-4** course, the final windward leg distance is extended upwind of Mark 1. This extension is entered as a whole or decimal number between 0.05 and 6,076 feet, metres or nm. With this value set to 0.05', the Finish Line Pin is effectively M1. The final windward leg is scaled up/down with the other legs to meet the Target Race Time.

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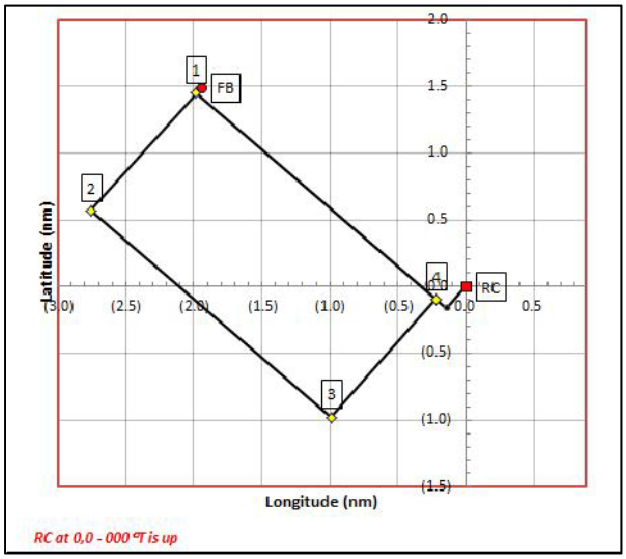
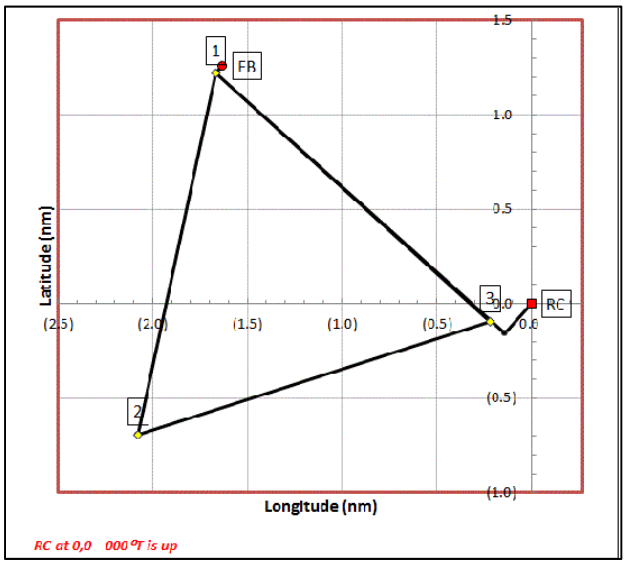
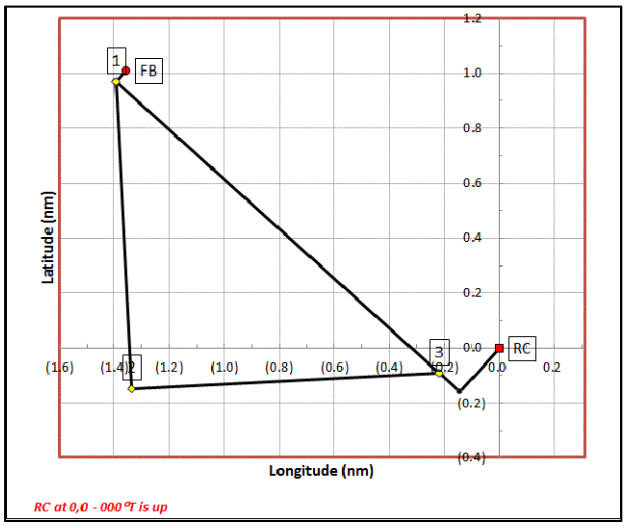
9. Lipton Challenge Cup Courses (R, T, O, and S)

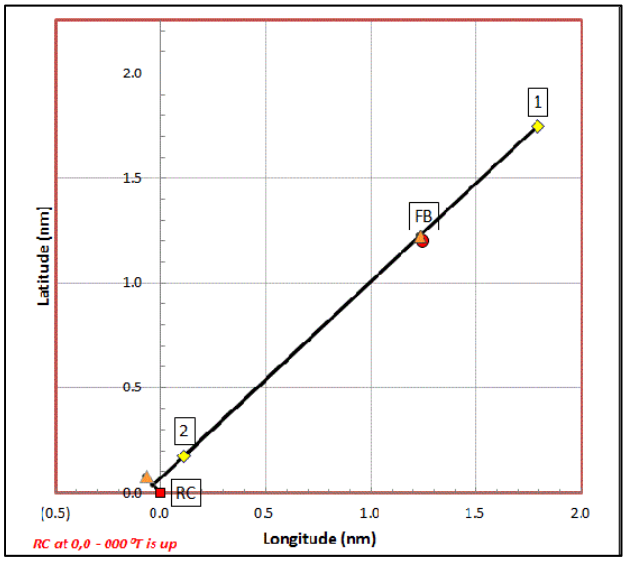
The four Lipton Challenge Cup courses are described in this section, and the **LiptonS** course is also mentioned in the Windward/Leeward section. The Lipton Cup Family includes four course types:

- Rectangular (R-1, R-2, and R-3 variations);
- Equilateral Triangle (T-1, T-2, and T-3 variations);
- Isosceles Triangle (O); and,
- Windward/Leeward (S-1, S-2, and S-3 variations).

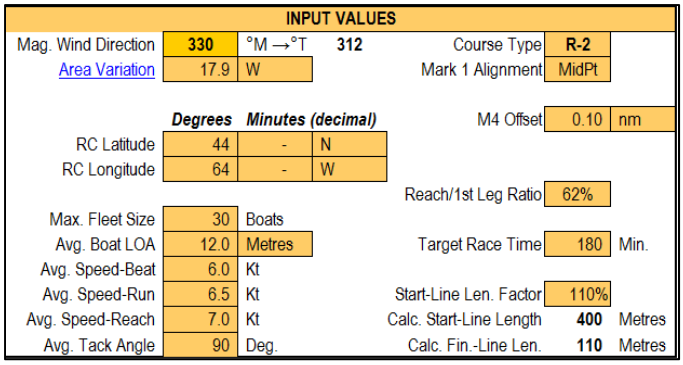








9.1 Rectangular Lipton R Course Input Values


INPUT VALUES
Mag. Wind Direction 330 °M →°T 312
Area Variation 17.9 W
Course Type R-2
Mark 1 Alignment MidPt
Degrees Minutes (decimal)
M4 Offset 0.10 nm
RC Latitude 44 - N
RC Longitude 64 - W
Reach/1st Leg Ratio 62%
Max. Fleet Size 30 Boats
Avg. Boat LOA 12.0 Metres
Target Race Time 180 Min.
Avg. Speed-Beat 6.0 Kt
Avg. Speed-Run 6.5 Kt
Start-Line Len. Factor 110%
Avg. Speed-Reach 7.0 Kt
Calc. Start-Line Length 400 Metres
Avg. Tack Angle 90 Deg.
Calc. Fin.-Line Len. 110 Metres

The common ezTrap Input Values are described in the Getting Started section of the manual.

This section described the Input Values that are unique to the **LiptonR** course – Course Type, and Reach to W/L Leg Ratio.

In order to ensure a rectangular course, the Included Angle at Mark 1, and all other turns are pre-set to 90°.

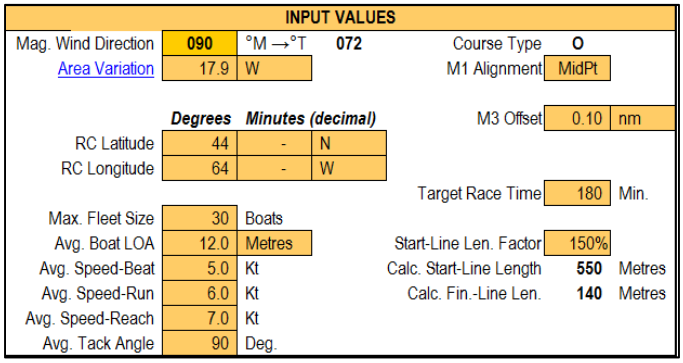
9.1.1 Lipton R Course Types

The user can select one of three variations of the Lipton R Course from the drop down list values: R-1, R-2 or R-3 for once, twice, and three times around (5, 9, or 13 legs) the rectangular course with an upwind finish leg at Mark 1. Optionally, Marks 3 and 4 can be offset from the starting line.

9.1.2 Lipton R Reach to W/L Leg Ratio (50-150%)

ezTrap allows the RO to adjust the proportions of the rectangular course with the (Beam) Reach to Windward/Leeward ratio, which is entered as a whole or decimal percentage between 50-150%. A 50% value will result in the W/L legs twice as long as the Reach Legs, and a 100% value will result in a square. ROs can use 61.8% to design a course with Golden Rectangle (Phi) proportions.

9.2 Lipton Triangle T and O Course Input Values


INPUT VALUES
Mag. Wind Direction 090 °M →°T 072
Area Variation 17.9 W
Course Type O
M1 Alignment MidPt
Degrees Minutes (decimal)
M3 Offset 0.10 nm
RC Latitude 44 - N
RC Longitude 64 - W
Target Race Time 180 Min.
Max. Fleet Size 30 Boats
Avg. Boat LOA 12.0 Metres
Start-Line Len. Factor 150%
Avg. Speed-Beat 5.0 Kt
Calc. Start-Line Length 550 Metres
Avg. Speed-Run 6.0 Kt
Calc. Fin.-Line Len. 140 Metres
Avg. Speed-Reach 7.0 Kt
Avg. Tack Angle 90 Deg.

The Equilateral Triangle Lipton T course and Isosceles Triangle Lipton O course have similar input values with the exception that the T course has three variations and no downwind (Run) legs.

- The T course is based on an equilateral triangle where all three internal angles are pre-set to 60° thereby making all 3-sides equal in length.
- The O course is based on an isosceles triangle where the first and third internal angles are pre-set to 45°, and the second to 90° thereby making it a right triangle where the two short sides equal in length.

9.2.1 Lipton T Course Types

The T course has three types that specify the number of rounds (1, 2 or 3) before an upwind finish at Mark 1.

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9.3 Lipton Windward/Leeward S Course Input Values

The Lipton S course is supported by the ezTrap Windward/Leeward Course and has 1, 2, or 3 rounds followed by a variable length upwind finish.

INPUT VALUES							
Mag. Wind Direction	090	°M →°T	113	Course Type	WL-5		
Area Variation	22.9	E		Marks 1&2 Align.	MidPt		
	Degrees	*Minutes (decimal)*		M2 Offset	0.20	nm	
RC Latitude	41	16.000	S	WL3,5&7 % Fin Dist.	62%	%	
RC Longitude	174	49.000	E				
				Target Race Time	60	Min.	
Max. Fleet Size	60	Boats					
Avg. Boat LOA	14.0	Feet					
Avg. Speed-Beat	8.0	Kt		Start-Line Len. Factor	150%		
Avg. Speed-Run	16.0	Kt		Calc. Start-Line Length	1,270	Feet	
Avg. Tack Angle	90	Deg.		Calc. Fin.-Line Len.	320	Feet	

9.3.1 Lipton S Course Types

The Lipton S course types are supported with three of the five ezTrap Windward/Leeward course types:

- **WL-3** is the equivalent of S-1;
- **WL-5** is the equivalent of S-2;
- **WL-7** is the equivalent of S-3.

9.3.2 Lipton S Course Finish Leg Distance (20-150% of W/L Leg)

For the S-1, S-2, and S-3 courses, the final windward leg distance is extended upwind (or downwind) of Mark 2 based on a percentage of the W/L leg distance. For example, 100% is the equivalent of having the Finish Pin at M1.

The final leg is also included in the calculation of the M2-M1 W/L Leg distance to meet the Target Race Time.

10. ezTrap Support

10.1 Registered Users

Once a person or entity becomes a Registered User, they may use their version of ezTrap on any suitable computer, and make back-ups or copies as needed. Further, they may show it or briefly lend it to another person with the understanding that it is for time-limited demonstration purposes only. Further, ROs for a major regatta may share copies of ezTrap only for the duration of the regatta.

At this time, we are using the honor system, and have not included software registration or other security controls to prevent unauthorized copies and distribution. Registered Users are provided with all maintenance updates, and email support at no charge.

10.2 On-going Development and Support

ezTrap was first developed in 2009 by Ed Bottrell, Glen Haven, Nova Scotia. The original versions were developed using MS Excel® 2007, and upgraded to 2010. It is also expected to be fully compatible with the newest version of MS Excel® 2013. ezTrap will be maintained for the PC versions of MS Excel® throughout the foreseeable future through the website http://www.xl4sail.com/ezTraphome.html

10.3 Compatibility with Older Versions of Excel®

ezTrap is available in the Excel® 2007/2010/2013 Macro-enabled Workbook format (.xlsm filename extension) and separately in the Excel® 97-2003 format (.xls).

The .xls version works properly in an Excel® 2003 environment; however it does not work in an Excel® 2000. To date, it has not been tested in other Excel® environments (e.g. Excel® XP).

Further, in Excel® 2007/2010/2013 the .xlsm file 'saved as' a 97-2003 .xls version will not work properly in Excel® 2003 – further modifications by the developer are required. For that reason, please ensure you have the correct version of ezTrap to match your Excel® environment.

10.3.1 MS Office 2007/2010/2013 Compatibility Pack

For unknown reasons, the MS Office 2007/2010/2013 Compatibility Pack with the SP1 update does not completely support the Excel® 2007/2010/2013 version of ezTrap (.xlsm) on older versions such as Excel® 2003. However, as described above the modified ezTrap (.xls) version works fine with Excel® 2003 and does not require the Compatibility Pack.

10.3.2 Documents-To-Go Premium by DataViz©

At this time, the DataViz© Documents-To-Go Premium software (i.e. Sheet-to-Go) for the BlackBerry, iPhone, etc. does not appear to support ezTrap.

10.4 Version History

Version	Date	Description
v8.0	February 25, 2010	Prepared for ezTrap Beta v8.0 Release
v8.9	March 15, 2010	Updated for Beta v8.9 Release that supports global Lat. & Long., variable Finish Leg, and other improvements
v9.2	April 2, 2010	Updated for Beta v9.2 that supports the Optimist Worlds Course, and other improvements.
v10.0	April 7, 2010	Updated for First Release – v10.0
v10.1	May 15, 2010	Metres, Feet or nm option for some Input Values, removal of Rel-HDGs from Course Information, Start Line Length formula adjusted to round up to next 10 units, Trapezoid course – increased Finish Leg

Version	Date	Description
		Angle range.
v10.2	June 15, 2010	Improved algorithm for meeting Target Race Times with Trapezoid Course. Windward/Leeward Course Added.
v11.0	April 30, 2011	Reorganized and updated for all course families. New 7-leg Trapezoid Course, Lipton Challenge Cup, and Yacht Club Courses added.
v11.2a	May 15, 2011	New RS:X Windsurfer Trapezoid and W/L Slalom courses added. Minor edit corrections to User's Manual.
v11.2b	May 31, 2011	Excel® 2003 (.xls) support described. Minor edit corrections to User's Manual.
v12.0	April 7, 2012	Major update V12 for new Bundles and Features including Trap6 1a option, Estimated Sailing Times by Leg, and POS Statistics.
V13.1	April 7, 2013	Improved ease of use, formatting, and consolidation into one application with dramatic price reductions. Macros added for hiding or displaying courses.

10.5 Acknowledgements

Special thanks to:

- Ric Hattin, P.Eng., CS30 Racer and Regatta Official, Seabright, Nova Scotia for helping with ezTrap design, Alpha & Beta Testing, and the business model.
- Jon Peltier, Sc.D., MS Excel® MVP, Peltier Technical Services, http://peltiertech.com/, Massachusetts, for help with the plotting and chart macros, and troubleshooting the Excel® 2003/2010 compatibility problems.
- Chris Veness, Moveable-Type Ltd., http://www.movable-type.co.uk/, Cambridge, UK for illustrating some of the underlying theory.
- Alan Keen, Laser Grand Master and Optimist PRO, Cape Town, SA for help with the Optimist Worlds Course and Lipton Challenge Cup Course Family.
- Mike Pothier, P.Eng., J29 Racer and Regatta Official, Halifax, Nova Scotia for helping with ezTrap Beta Testing and compatibility with different versions of MS Excel®.
- And thanks to the many Beta testers around the world.

10.6 About the Developer

About the Developer: Ed Bottrell is a life-long boater with keelboat racing and cruising experience in the Great Lakes, South Pacific, and Atlantic Canada. He has been a part of the race management of numerous local, regional, national and international regattas for dinghies, keelboats, and ocean racers. He is a former Canadian Yachting Association Senior Instructor-Evaluator for the Cruising & Power Boat Programs, Club Race Officer, and Coastal Navigation Instructor. Ed has a BSIE degree in industrial and systems engineering from Kettering University, Flint, MI, and has held professional certifications in management consulting, project management, and information systems. Ed and his wife Hazel live on St. Margaret's Bay, Nova Scotia, Canada.

10.7 Disclaimers

Every reasonable effort has been made to ensure that the functional and graphical results of ezTrap are correct; however, no liability is assumed, and users shall have the final responsibility for designing and managing any race course. This User's Manual contains some relevant observations and notes about race management but is not intended to be an instructional guide.

10.8 Glossary of Terms

Bearing (BRG)	Direction of a mark or other object measured in Magnetic (°M) or True (°T) degrees (000-359). See Relative Bearings and Headings.
Course-Setter	Race Committee person responsible for designing and managing the set-up of the Course. May also be the Race Officer or Principal Race Officer.
Deviation	Local effect on a ship's magnetic compass caused by iron, magnetic fields, and other on-board factors. Deviation will vary depending on the heading of the ship. Any bearings or headings from/to the ship's magnetic compass should be corrected with the ship's Deviation Card before use as Magnetic Readings. Hand-held magnetic compasses are not generally affected by Deviation.
Drift	The speed of a current in knots (kt). See Set. To be incorporated as an optional Input Value with future releases of ezTrap.
Finish Boat (FB)	The race committee boat at the Finish-Line, which includes a Finish-Pin at the opposite end.
GPS	Global Positioning by Satellite system. Provides Latitude, Longitude, Time, Bearings, and other information to hand-held or installed GPS electronic devices. It is important that all GPS units used for a Regatta be set (and verified) to the same parameters (e.g. True or Magnetic Directions, GPS Reference Datum, measurement units, etc.
Gybe or Jibe	Turning the boat through the wind on the stern requiring the mainsail and boom to move to the opposite side.
Heading (HDG)	Direction the boat is pointing or moving measured in Magnetic (°M) or True (°T) degrees (000-359°). See Relative Bearings and Headings.
Knot (kt)	Unit of speed. 1.0 knot = Nautical Mile per Hour = 1.15 Statute Mile per Hour = 1.85 Kilometre per hour.
Latitude	Imaginary line on the globe parallel to the equator. The location of the line is the angular measurement, expressed in degrees (0-90°), North or South of the equator. The angle is formed by the plane of the equator and a line from the center of the earth to any point on the imaginary line of latitude. In combination with Longitude, will define a unique point on the surface of the globe. A Nautical Mile (nm) is defined as one minute of Latitude on the surface of the earth, which is also equal to 1,852 metres or 6,076 feet. Latitude scales (i.e. degrees and decimal minutes) are typically shown on the left and right side of Nautical Charts.
Leeward	Away from the wind.
Leeward Mark	The mark at the end of a downwind run.
Longitude	Imaginary line on the globe that includes the North and South Poles – also known as a Great Circle. The location of the imaginary line is the angular measurement, expressed in degrees (0-180°), East or West of the Prime Meridian that runs through Greenwich, England. In combination with Latitude, will define a unique point on the surface of the globe. Longitudes are shown on the top and bottom of Nautical Charts. Longitudinal distances vary depending on the Latitude.
Magnetic Declination	Same as Variation. Difference between magnetic and true North, which is measured in degrees East or West for a given local area. See Variation.
Mark	A buoy or floating object designated as a turning point on the course. Often a brightly colored, inflated tetrahedron.
Mark Boat	A race committee support boat responsible for setting (and moving) one or more marks.

Metre	Common metric measure of distance, and used by some ROs for some distance measures. Sometimes spelled as 'meter', which is more properly used to describe an instrument of measurement (e.g. thermometer, speedometer, odometer, etc.) ezTrap uses conversion factors based on: 1.0 nm = 6,076 feet = 1,852 metres. nm / Metres / Feet 1.00 / 1,852 / 6,076 0.02 / 30 / 100 0.08 / 152 / 500 0.16 / 305 / 1,000 0.03 / 50 / 164 0.05 / 100 / 328 0.08 / 150 / 492 0.05 / 93 / 304 0.10 / 185 / 608 0.15 / 278 / 911
Nautical Mile (nm)	Common measure of nautical distance, especially when working with nautical charts and navigation. 1.0 nm = 6,076 feet = 1,852 metres. Also equal to one minute of Latitude. Approximately 115% longer than a statute mile, and 185% longer than a kilometre.
Pin	A buoy, typically a ball or cylinder marking the end of the Start and Finish Lines, and opposite an RC or Finish Boat.
Port	Left side of a boat facing the bow. Turning to Port means turning in the direction of the left side of the boat when facing the bow – even when operating astern.
Race Committee (RC)	The people who organize and conduct the race(s). Also used as Race Committee Boat to indicate the boat with the RO responsible for running the race, and the source of visual, sound, and radio signals. See Signals Boat.
Race Officer (RO)	Race Officer or Principal Race Officer (PRO) for the race. On the water responsibility for Course, race management resources, and the conduct of the race(s). May also be the Course Setter.
Relative BRG or HDG	Relative bearings or headings are with reference to the bow of the boat as 000, and are expressed in degrees (000-180 degrees) to Port or Starboard.
Set	The direction (000-359°) of a current. See Drift. To be incorporated as an optional Input Value with future releases of ezTrap.
Signals Boat	Same as RC Boat. Boat with the RO responsible for running the race, and the source of visual, sound, and radio signals. Usually forms one end of the Start-Line. See RC.
Starboard	Right side of a boat facing the bow. Turning to Starboard means turning in the direction of the right side of the boat when facing the bow – even when operating astern.
Time	Conventional definition of local time in hours, minutes and seconds. 24-hour time system, sometimes with reference to universal coordinated time (UCT), typically used for navigation records.
Variation	Same as magnetic declination. Variation is the difference between magnetic and true North, which is measured in degrees East or West for a given local area. See magnetic declination
Weather Mark	Same as Windward Mark. Designated upwind racing buoy at the end of a beat into the wind, and known as Mark 1. See Windward Mark.
Windward	Towards the wind. Sailing to windward involves tacking, also known as beating. See Tacking and Beating.
Windward Mark	Same as Weather Mark. Designated upwind racing buoy at the end of a beat into the wind, and known as Mark 1. See Weather Mark.
Wing Mark	Same as Gybe Mark. Rounding the Gybe mark involves a Gybe.